

Department of Higher Education, Govt. of M.P.

Post graduate semester wise syllabus

As recommended by Central Board of studies and approved by the governor of M. P.

उच्च शिक्षा विभाग, मध्यप्रदेश शासन

स्नातकोत्तर कक्षाओं के लिए सेमेस्टर अनुसार पाठ्यक्रम

केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Session ( सत्र ) - 2015-16

Scheme of Marks

M. Sc. Drugs and Pharmaceutical Chemistry

SEMESTER- I

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Introduction to Pharmacy, Drug Regulatory Act, Intellectual Property Rights	PC-101	40+10 (CCE) = 50
II	Compulsory	Pharmaceutical Chemistry & Biochemistry	PC-102	40+10 (CCE) = 50
III	Compulsory	Principles of Organic Pharmaceutical Chemistry	PC -103	40+10 (CCE) = 50
IV	Compulsory	Principles of Physical Pharmacy -I	PC-104	40+10 (CCE) = 50
V	Optional- 1	Mathematics and statistics for chemists (for biology background students)	PC -105 (a)	40+10 (CCE) = 50
VI	Optional- 2	Biology for chemists (for mathematics background students)	PC -105 (b)	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		TOTAL		400

M. Sc. Drugs and Pharmaceutical Chemistry

SEMESTER- II 2016 - 17

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Principles of Inorganic Pharmaceutical Chemistry -I	PC-201	40+10 (CCE) = 50
II	Compulsory	Pharmaceutical Analysis -I	PC-202	40+10 (CCE) = 50
III	Compulsory	Pharmaceutical Analysis - II	PC -203	40+10 (CCE) = 50
IV	Compulsory	Principles of Physical Pharmacy -II	PC-204	40+10 (CCE) = 50
V	Optional- 1	Computers for Chemists	PC -205	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		TOTAL		400

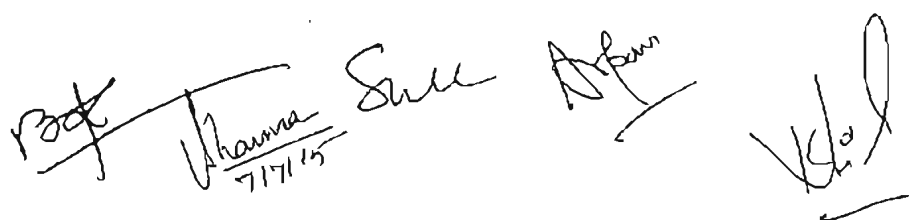
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**M. Sc. Drugs and Pharmaceutical Chemistry**  
**SEMESTER- III 2015-16**

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Principles of Physical Pharmacy-iii	PC-301	40+10 (CCE) = 50
II	Compulsory	Principles Of Pharmacognosy	PC-302	40+10 (CCE) = 50
III	Compulsory	Pharmaceutical Medicinal Chemistry-I	PC -303	40+10 (CCE) = 50
IV	Compulsory	Principles Of Inorganic Pharmaceutical Chemistry- II	PC-304	40+10 (CCE) = 50
V	Optional- 1	Instrumental Methods of Analysis	PC -305	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		TOTAL		400

**M. Sc. Drugs and Pharmaceutical Chemistry**  
**SEMESTER- IV 2016-17**

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Pharmaceutical Medicinal Chemistry-ii	PC-401	40+10 (CCE) = 50
II	Compulsory	Drug Design And Medicinal Chemistry	PC-402	40+10 (CCE) = 50
III	Compulsory	Advance Chemistry	PC -403	40+10 (CCE) = 50
IV	Compulsory	Supplements, Additives And Toxicology	PC-404	40+10 (CCE) = 50
V	Optional- 1	Drug Pharmacokinetics And Drug Development	PC -405	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		PROJECT		50
		TOTAL		450


  
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SEMESTER FIRST  
2015-16  
M.Sc. (Drugs and Pharmaceutical Chemistry)  
Syllabus

**Pharmaceutical Chemistry paper I**

**PC-101 Introduction to Pharmacy, Drug Regulatory Act, Intellectual Property Rights**

**Unit I**

Introduction to Pharmacy, Careers in Pharmacy, Codes of pharmaceutical ethics, Importance of Pharmaceutical Chemistry, Pharmacopeia & its history (IP, BP, USP, NF)

**Unit II**

Routes of drug administration, Introduction to tablets, capsule, suspension, emulsion, ointments etc, Introduction to NDDS.

**Unit III**

Drug and Cosmetics Act with special reference to schedule M, GMP, GLP, GCP, USFDA, NDA, ANDA, Clinical Trials

**Unit IV**

Concept of Quality & total Quality Management, Quality Assurance & Quality Control, IPQA, IPQC.

**Unit V**

Documentation and Maintenance of records, Intellectual property rights patents, Trademarks, Copyrights, Patents Act.

**Books Recommended:**

1. Willing, S.W., & Stoker, Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker, New York.
2. Guarino, R.A., New Drug Approval Process, Marcel Dekker, New York.
3. Drug & Cosmetic Act.
4. Patents Act.
5. Consumer Protection Act.
6. Environmental Protection Act.
7. Federal Food, Drug & Cosmetic Act.
8. Bansol, IPR Guidelines for Pharm students and Researchers.
9. Pisano-FDA Regulatory Affairs.
10. Phillip W. Grubb, Patents for Chemicals, Pharmaceuticals and Biotechnology.
11. Lehninger principles of biochemistry, Albert L. Lehninger, David Lee Nelson, Michael M. Cox, W.H. Freeman, 2008.
12. Harper's Illustrated Biochemistry, Robert K. Murray, Mc. Graw Hill.
13. Biochemistry, keshav Trehan, New age Publishers.
14. Remington- vol I & II

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*Dr. Kalpana Singh*

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## Pharmaceutical Chemistry paper II

### PC-102 PHARMACEUTICAL CHEMISTRY & BIOCHEMISTRY

#### Unit I

Chemical structure and biological activity, Study of relationship between physico-chemical properties and biological potencies of drugs. Metabolic changes of drugs & related organic compounds in the body.

#### Unit II

Classification of drugs on the basis of

(i) Chemical Structure

(ii) Therapeutic action (at least one example of each class).

Drug Receptors:

(i) Nature of drug receptors

(ii) Isolation of drug receptors

(iii) Receptor theories

(iv) Types of drug receptors

#### Unit III

Heterocycles: - Synthesis reactivity reactions applications and biological significance of the following: -

(A) Mono Hetero Atom Systems: - Indole, Quinoline, Isoquinoline.

(B) Multi Hetero Atom Systems: - Diazole, Pyrazole, Oxazole.

#### Unit IV

Biochemical organization of the cell and transport processes across cell membrane, bioenergetics, production of ATP and its biological significance.

Enzymes: Nomenclature, Kinetics and its Mechanism of action, Mechanism of Inhibition, Isoenzymes, enzymes in technical diagnosis.

#### Unit V

Disorders of Carbohydrate, Lipid and Protein Metabolism, Biomedical Importance and Implications in Clinical Biochemistry, Diagnostic tests for detection of metabolic disorders,

Urea cycle, metabolic disorders of urea cycle.

Books Recommended:

1. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
2. Harpers- illustrated Biochemistry.
3. A. C. Deb- fundamental of biochemistry.
4. Martin YC. "Quantitative Drug Design" Dekker, New York.
5. Lien EJ. SAR " Side effects and Drug Design" Dekker, New York.
6. William H, Malick JB " Drug Discovery and Development" Humana Press Clifton.
7. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
8. Foye W.O.- "Principles of Medicinal chemistry 'Lea & Febiger.
9. Hetrocyclic Chemistry- R.K. Bansal, New Age Publication.
10. Name reactions and reagents in organic synthesis- Bradford P. Mundy, Michael G. Eller, Wiley Publisher.

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### Unit I

Stereo Chemistry and Conformational Analysis:

Optical Isomerism- Concept of Chirality, recognition of symmetry elements and chiral structures, R-S nomenclature, Diastereomerism in acyclic and cyclic systems, Optical activity without asymmetric carbon atom (allenes, spiranes and biphenyls)

### Unit II

Geometrical Isomerism: Geometrical isomerism of olefins and oximes, E-Z nomenclature.

Conformational Analysis: conformational analysis of ethane, butane, cyclohexane and decalines. Effect of conformation on reactivity in acyclic compounds and cyclohexanes, Interconversion of Fischer, Newman and Sawhorse projections.

Stereo selective Synthesis: Asymmetric Synthesis

### Unit III

(A) Reaction Intermediates: Structure, formation and examples of participation in chemical reaction of the following: - Carbocation, Carbanion, Nitrenes, Carbenes, Arynes, Free radicals.

(B) Mechanism of Organic Reactions: - Types of reactions, thermodynamic and kinetic requirements. Potential energy diagram, methods of determining reaction mechanisms,

(C) Aliphatic Nucleophilic Substitution:  $SN_1$ ,  $SN_2$ ,  $SN_i$ , factors affecting mechanism, hydrolysis of ester,

### Unit IV

Elimination Reactions:  $E_1$ ,  $E_2$  and  $E_{1cb}$  mechanism, Hoffman and Saytzeff elimination.

Addition Reactions: General mechanism, hydroboration, epoxidation, Wittig reaction.

Aromaticity concept: Huckle's rule and its limitations, Benzenoid and non- benzenoid compounds, cyclopentadienyl anion, tropylium cation, azulenes, fullerenes.

Synthetic applications, mechanisms and stereochemistry (wherever applicable) of the following organic reactions and molecular rearrangements; - Pinacol - pinacolone rearrangements, Benzilic acid rearrangement, Beckmann rearrangement, Hoffmann- Curtius, Lossen and Schmidt rearrangement, Claisen rearrangement .

### Unit V

Study of reactions of synthetic importance: mechanisms and stereochemistry (where ever applicable)

Birch reduction, Mannich reaction, Meerwein Ponderf - Verley reduction and Oppeneaur oxidation, Ozonolysis and hydrogenation, Diel's Alder reaction, Reformatsky reaction, Grignard reaction.

### Books Recommended:

1. Eliel, E.L., Stereochemistry of Carbon compounds. MC.Graw Hill Book Company, Inc. New York.

2. March, J., Advanced Organic Chemistry, Reaction Mechanism and Structure, John Wiley and sons, New York.

3. Singh, H and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan Delhi.

4. Gould, E.S., Mechanism and structure in Organic Chemistry, Holt, Rinewart and Winston , New York.

5. Abraham D.J., ed.,Burger's Medicinal Chemistry & Drug Discovery, Vol. I-VI, John Wiley & sons, New Jersey.

6. Ford M.E., Catalysis of organic reactions, Marcel Dekker Inc., New York.

7. Laszlo Kurti, Barbara Czako, Strategic Applications of Name reaction in Organic Synthesis, Elsevier, Academic Press, New York.

8. P S Kalsi, Organic reactions and their mechanism.

9. Wohalard- organic chemistry.

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**Pharmaceutical Chemistry Paper IV**  
**PC-104 PRINCIPLES OF PHYSICAL PHARMACY –I**

**Unit I**

**Basic Principles of Physical Pharmacy**

Thermodynamics: the first law of thermodynamics, isothermal and adiabatic processes, ideal gases and the first law, heat of formation, Hess's law and heat of combustion, heats of reaction from bond energies, second and third law of thermodynamics, free energy functions and applications, Gibbs- Helmholtz equation.

**Unit II**

Determination of the physical properties of molecules: Molecular structure, additive and constitutive properties, refractive index and molar reflection, types of solutions, concentration expressions (molarity, molality, normality, mole fraction), ideal and real solutions, Raoult's law, Henry's law.

**Unit III**

Buffers in pharmaceutical and biological system: buffer, the buffer equation, factors affecting pH of buffer, buffer capacity, in-vivo biological buffer system, pharmaceutical buffers, preparation of pharmaceutical buffer solutions, influence of buffer capacity and pH on tissue irritation, methods of adjusting tonicity and pH.

**Unit IV**

(A) Interfacial Phenomena, Application of Surfaces Active Agents, Electric Properties of Interfaces, Application in Pharmacy.

(B) Micromeritics

Particle size and size distribution, Methods for determining particle Size, Derived Properties of Powders, Application in Pharmacy.

**Unit V**

**Rheology**

Introduction, Newtonian Systems, Non-Newtonian Systems, Thixotropy, Determination of Rheology Properties, Viscoelasticity, Application in Pharmacy.

**Books recommended:**

1. Martins- Physical Pharmacy and Pharmaceutical Sciences, Patrick J. Sinko, Lippincot Williams and Wilkins.
2. Textbook of Physical Pharmaceutics, CVS Subrahmanyam, Vallabh Parkashan, New Delhi.
3. Physical Chemistry, P.W. Atkins, ELBS.
4. Chemical Kinetics, K.J. Laidler, McGraw-Hill Kinetics and Mechanism of Chemical Transformation J. Rajaraman and J. Kuriacose, Mc Millan.
5. Text Book of Polymer Science, Fred. W. Billmeyer, 3rd edition, Wiley Interscience Publication, John Wiley and Sons.
6. Introduction to Polymers Sciences and Technology, S.D. Dawande, 1st edition, Denett and Co., Nagpur.
7. Polymer Science, V.R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, New Age International, New Delhi.
8. Polymers in Drug Discovery, Ijeoma F. Vihegbu, Andreas G. Schatzlein, Taylor and Francis.
9. Biodegradable hydrogels for drug delivery, Kinam Park, Waleed S.W. Shalaby, CRC Publisher.
10. Organic Chemistry, I.L. Finar, Vol.-I and II, 6th Edition, Pearson Education Asia.
11. Chemistry of Natural Products, S.V. Bhat, B.A. Nagasampegi, M. Sivakumar, Springer Publication.
12. Glycopeptides and Glycoproteins, Synthesis, Structure and Applications Volume

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**Pharmaceutical Chemistry paper V**

**PC -105 (a) MATHEMATICS AND STATISTICS FOR CHEMISTS (for biology background students)**

**Unit I**

Matrix Algebra: - Addition and multiplication inverse adjoint and transpose of matrices, special matrices (Symmetric, skew symmetric Hermitian, Skew Hermitian, unit diagonal, unitary etc.) and their properties. Matrix equations - : homogeneous, non independence linear equations and conditions for the solution linear dependence and independence introduction to vector spaces, matrix eigen values and eigen vectors diagonalization, determination (examples form Huckles theory )

**Unit II**

Differential Calculus: - Functions continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima exact and inexact differentials.

**Unit III**

Integral Calculus: - Basic rules for integration, integration by partial fraction and substitution, Reduction formulae, Applications of integral calculus, Functions of several variables partial differentiation co-ordinate transformation (e.g. Cartesian to spherical polar) curve sketching.

**Unit IV**

Elementary Statistics:-Organizing and displaying data, Variables, univariate data bivariate data, random variables.

Summarizing data and variation; The mean, the median the mode, the mean deviation, the variance and standard deviation, coefficient of variation.

**Unit V**

Permutations and combinations: -

Probability, Definitions rules of probability Distributions (binomial and normal distributions) Regression and correlation, Introduction, simple linear regression model correlation coefficient.

**Book Recommended:**

1. Bolton, Pharmaceuticals Statistics- Practical & Clinical Applications, Marcel & Dekker, New York.
2. Fisher, R.A., Statistical Methods for Research Works, Oliver & Boyd, Edinburgh.
3. Chow, Statistical Design and Analysis of Stability Studies, Marcel Dekker, New York.
4. Buncher, Statistics in the Pharmaceutical Industry, Marcel Dekker, New York.
5. Finney, D.J., Statistical Methods in Biological Assays, Hafner, New York.
6. Montgomery, D.C., Introduction to Statistical Quality Control, Willy.
7. Khan, Irfan A., Biostatistics for Pharmacy.

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## Pharmaceutical Chemistry paper V

### PC -105 (b) BIOLOGY FOR CHEMISTS (for mathematics background students)

#### Unit I

##### Cell Structure and Functions

Structure of prokaryotic and eukaryotic cells intracellular organelles and their functions, Comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism.

#### Unit II

Carbohydrates, Conformation of monosaccharides structure and functions of important derivatives of monosaccharides, disaccharides and polysaccharides.

Role of sugars in biological systems, Carbohydrate metabolism-Kreb's cycle, glycolysis, glycogenesis and glycogenolysis gluconeogenesis, pentose phosphate pathway.

#### Unit III

Lipids, Fatty acids, essential fatty acids, function of triacylglycerols, glycerophospholipids, sphingolipids cholesterol, bile, prostaglandins, Lipoproteins.

Lipid metabolism, oxidation of acids.

#### Unit IV

Amino -acids, Peptides and proteins, Chemical and enzymatic hydrolysis of proteins to peptides, Amino acids, Primary & secondary structure of proteins, Chemistry of oxytocin and tryptophan releasing hormone (TRH).

#### Unit V

Nucleic Acids, Purines and pyrimidine bases of nucleic acids, base pairing via-H-bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acids (DNA), double helix model of DNA, replication of DNA transcription, translation and genetic code.

#### Book Recommended

1. Trease and Evans, Pharmacognosy, 15th edition, Elsevier.
2. Burger's Medicinal Chemistry, 6th edition, Vol-I, Wiley Interscience, New York.
3. Chemistry of natural products by S.V. Bhat, B.A. Nagasampegi, Springer publications. New York.
4. Finar, Organic Chemistry, Vol-I
5. Drug Discovery and Evaluation, Pharmacological assays, H. Gerhard Vogel, 2nd edition, Springer publications,
6. Quality Control of Herbal drugs, an approach to evaluation of botanicals, by Pulok Mukherjee, Business Horizon Publications.
7. Pharmacognosy and Pharmacobiotechnology, by Ashutosh Kar, New age International publications.
8. Role of Biotechnology in Medicinal and Aromatic plants, Vol-XIII, Ukaaz Publications, Hyderabad.
9. Supplement to cultivation and utilization of medicinal plants, S.S. Handa and M.K. Kaul, RRL Jammu.
10. Chemistry of Natural Products, by O.P. Agarwal, Vol-I & II.
11. Harpers- Illustrated Biochemistry.
12. A.C. Deb- Fundamental of Biochemistry.

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**SEMESTER FIRST**  
**2015-16**  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Practical Syllabus**

***First semester Practical's***

- 1) Stereochemical studies of organic compounds with the help of molecular model kit.
- 2) Preparation of drug or organic compound.
- 3) Organic Synthesis Using Microwave Oven.
- 4) Synthesis of metal complexes and determination of their anti microbial activity.
- 5) Inorganic Preparation of compounds like Ferrous sulphate, magnesium Carbonate, calcium carbonate, alum, zinc oxide, magnesium trisilicate, dicalcium phosphate.
- 6) Limit test for chloride and sulphate.
- 7) Determination of particle size by microscope.
- 8) Determination of derived properties of powders.
- 9) Preparation of suspensions and study of its sedimentation parameter.
- 10) Preparation of emulsions.
- 11) Preparation of ointment.
- 12) Preparation of pharmaceutical buffer and study of its theoretical and calculated pH.
- 13) Preparation of aromatic waters, spirits, solutions, tinctures.
- 14) Preparation of simple syrup as per IP and USP.

**SEMESTER FIRST**  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Examination scheme**

**Duration -8 Hours**

**Total Marks -100**

**Minimum Passing Marks-33**

***Examination scheme: - First semester***

- |                                                                                                                                                                      |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1. Synthesis of drug and organic compound.                                                                                                                           | (10 marks) |
| 2. Preparations of Inorganic compound.                                                                                                                               | (10marks)  |
| 3. Limit test.                                                                                                                                                       | (10 marks) |
| 4. Pharmaceutical Preparations like Suspension,<br>Aromatic water, Solutions, Spirits. (Any two)                                                                     | (20 marks) |
| 5. Preparation of pharmaceutical buffer and study of its<br>Theoretical and calculated pH. Or<br>Preparation of suspensions and study of its sedimentation parameter | (15 marks) |
| 6. Preparation of tinctures.                                                                                                                                         | (5 marks)  |
| 7. Preparation of simple syrup IP and USP                                                                                                                            | (5 marks)  |
| 8. Viva-Voce                                                                                                                                                         | (15 marks) |
| Practical Record                                                                                                                                                     | (10 marks) |

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SEMESTER SECOND  
2015-16  
M.Sc. (Drugs and Pharmaceutical Chemistry)  
Syllabus

**Pharmaceutical Chemistry paper I**

**PC 201 PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY – I**

**Unit I**

Impurities in Pharmaceutical Substances and their tests:-

- (A) Sources of impurities in pharmaceutical chemicals.
- (B) Effect of impurities.
- (C) Permissible impurities in pharmaceutical substances.
- (D) Limit tests.

Synthesis, properties and uses of inorganic compounds of pharmaceutical importance

- (A) Topical drugs: - dusting powders, Lubricants astringents
- (B) Gastro-intestinal drugs: - antacids, digestants, emetics
- (C) Respiratory drugs: - expectorants and antitussives.

**Unit II**

Structure and Bonding I

- A) Chemical periodicity, structure and bonding in homo and heteronuclear molecules including shapes of molecules (VSEPR theory)
- B) Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents

**Unit III**

Transition elements and Coordination compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compound.

Inner transition elements: Spectral and magnetic properties, reaction mechanism

**Unit IV**

A) Complexing and chelating agents used in therapy,

B) Dental product: Dentifrices, anti-caries agents.

C) Bioinorganic Chemistry: photosystems, porphyrin, metalloenzymes. Oxygen transport, electron-transfer reactions: nitrogen fixation

**Unit V**

Structure and Bonding II

Boron hydrides: Polyhedral boranes, hydroboration, carboranes and metallo-carboranes

Cages and metal clusters.

**Books Recommended:**

1. Roger's Inorganic Pharmaceutical Chemistry, Charles Herbert Rogers, Tailo Olaf Soine, Lea and Fabiger pub.
2. Inorganic Pharmaceutical Chemistry, K. G. Bothra, Nirali Prakashan.
3. Inorganic Pharmaceutical Chemistry, G. R. Chatwal, Himaliya Publication

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Pharmaceutical Chemistry paper II  
PC- 202 PHARMACEUTICAL ANALYSIS -I

**Unit I**

UV-Visible Spectroscopy: Basic principles and brief outline of instrumentation, Types of electronic transition, Effect of solvent on transition, Chromophores and their interaction with UV-visible radiation and their utilization in structural, qualitative and quantitative analysis of drug molecules, Woodward-Fieser rule, Fundamentals of Optical rotatory dispersion, Cotton effect curves, Octant rule, Circular dichroism.

**Unit II**

Infrared Spectroscopy: Basic principles and brief outline of instrumentation, Infrared radiation and its interaction with organic molecules, Vibrational mode of bonds, effect of hydrogen bonding and conjugation on absorption bands, applications, interpretation of IR spectra, FTIR and ATR.

**Unit III**

Nuclear magnetic resonance spectroscopy: Basic principles and brief outline of instrumentation, Magnetic properties of nuclei, field and Precession, chemical shift concept, isotopic nuclei, reference standards and solvents, <sup>1</sup>H NMR spectra, chemical shifts, multiplicity, coupling constants, free induction decay, average time domain and frequency domain signals, Spin-spin and spin-lattice relaxation phenomenon. Protein noise decoupled spectra. Nuclear overhauser enhanced <sup>13</sup>C NMR spectra, their interpretation and application, APT and DEPT techniques, Introduction of 2D NMR techniques, COSY, with application.

**Unit IV**

Mass spectrometry: Basic principles and brief outline of instrumentation, Ion formation, molecular ion, metastable ion, fragmentation process in relation to molecular structure and functional groups, Relative abundance of isotopes, chemical ionization, FAB, ESI, Maldy, GC-MS and other recent advances in mass spectrometry.

**Unit V**

Electron spin resonance spectroscopy: - Basic principles zero field splitting and Kramer's degeneracy, Factors affecting the "g" value, Isotropic and anisotropic hyperfine coupling, Spin Hamiltonian, spin densities and Mc Connel relationship measurement techniques, applications.

**Books Recommended:**

1. Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A., Instrumental Methods of Analysis, Van Nostrand.
2. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.
3. Hunson, J.W., ed. Pharmaceutical Analysis, Modern Methods, part A & B, Marcel Dekker.
4. Schirmer, R.E., ed. Modern Methods of Pharmaceutical Analysis, Vols 1, 2. Boca Raton F.L., CRC Press.
5. Mann, C.K., et al., Instrumental Analysis Harper & Row.
6. Jaffe, H.H., Orchin M., Theory & Applications of Ultraviolet Spectroscopy, Willy.
7. Silverstein, Spectrometric identification of Organic Compounds, Willy.
8. Bovey, F., Jelinski, L., Miran, P., Nuclear Magnetic Resonance Spectroscopy, San Diego Academic.
9. Stothers, J.B., Carbon-13 NMR Spectroscopy, Academic.
10. Gordy, W., Theory & Applications of Electron Spin Resonance, Willy.
11. Haswell, S.J., ed. Atomic Absorption Spectroscopy, Elsevier.
12. Ardrey, R.E., Pharmaceutical Mass Spectra, Pharmaceutical Press, London.
13. Budzikiewicz, et al., Interpretation of Mass Spectra of Organic Compounds, Holden-Day San Francisco.
14. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.

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15. Stahl, E., Thin Layer Chromatography- A laboratory Handbook, Springer-Verlag
16. Giddings, J.C., Principles and Theory- Dynamics of Chromatography, Marcel Dekker.
17. Sethi, P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
18. Kemp William, Organic spectroscopy, Pal grave, New York.
19. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi.
20. Gross - Mass Spectrometry
21. WHO - Quality Assurance of Pharmaceuticals, Vol. I, II.
22. Sethi, P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
23. Sethi, P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
24. Haffmann, Chromatography.
25. Sethi and Charegankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
26. Robert D. Braun, Introduction to Instrumental Analysis.
27. Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry
28. Harry G. Brittain, Spectroscopy of Pharmaceutical Solids.
29. George, S., Steroid Analysis in Pharmaceutical Industry.
30. Higuchi, Pharmaceutical Analysis.
32. Hoffmann, Mass Spectrometry: Principle and Application.
33. Scott, Techniques and Practice of Chromatography.
34. Wilkins, Identification of Microorganism by Mass Spectrometry.
35. G. R. Chhatawal- Instrumental Method of Analysis.

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**Pharmaceutical Chemistry Paper III**  
**PC -203 PHARMACEUTICAL ANALYSIS - II**

**Unit I**

Chromatography: General principles, classification of chromatographic techniques, normal and reversed phase, bonded phase, separation mechanisms.

**Unit II**

Principles Instrumentation and applications of - Thin layer chromatography, column chromatography, gas-liquid chromatography and Flash chromatography

**Unit III**

High performance liquid chromatography, ion exchange chromatography, size exclusion gel chromatography, Chiral Chromatography

**Unit IV**

Principle of liquid-liquid extraction and solid liquid extraction, distribution law, factors favouring solvent extraction, Sequences of the extraction process, Extraction techniques, soxhlet extraction, Important applications of liquid-liquid extraction.

**Unit V**

A) General Titrimetry and Gravimetric analysis, determination of dissolved oxygen (DO) Biological oxygen demand (BOD), Chemical oxygen Demand (COD).

B) I.P. methods for water analysis, zeta sizer, C,H,N analyzer.

**Books Recommended:**

1. Pharmaceutical analysis, David C. Lee, Michael Webb, Wiley India.
2. Handbook of Modern Pharmaceutical Analysis, Satinder Ahuja, Stephens Scypinski, Academic Press
3. Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A., Instrumental Methods of Analysis, Van No strand.
4. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.
5. Hunson, J.W., ed. Pharmaceutical Analysis, Modern Methods, part A & B, Marcel Dekker.
6. Schirmer, R.E., ed. Modern Methods of Pharmaceutical Analysis, Vol. 1-2. Boca Raton F.L., CRC Press.
7. Mann, C.K., et al., Instrumental Analysis Harper & Row.
8. Jaffe, H.H., Orchin M., Theory & Applications of Ultraviolet Spectroscopy, Willy.
9. Silverstein, Spectrometric identification of Organic Compounds, Willy.
10. Bovey, F., Jelinski, L., Miran, P., Nuclear Magnetic Resonance Spectroscopy.

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Pharmaceutical Chemistry Paper IV  
PC-204 PRINCIPLES OF PHYSICAL PHARMACY -II

**Unit I**

Pharmacokinetics

Introduction including clinical pharmacokinetics, toxicokinetics and clinical toxicology, therapeutic concentration range, doses regimen, plasma drug concentration.

Pharmacokinetic and pharmacodynamic parameters including peak plasma concentration, time of peak concentration, area under the curve, minimum effective concentration, maximum safe concentration, fraction of the drug absorbed.

**Unit II**

Chemical Kinetics I

Rates of chemical reaction, factors influencing the rate of a reaction: concentration, temperature, pressure, solvent, light, catalyst Concentration dependence of rates. Mathematical characteristics of simple chemical reactions – zero order, first order, second order and third order reactions, methods of rate determination, Arrhenius equation, Concept of activation energy.

Simple collision theory based on hard sphere model transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

**Unit III**

Electro Chemistry: Electrical transport, Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, Migration of ions and Kohlrausch law. Arrhenius theory of electrolytic dissociation and its limitations, weak and strong electrolytes Oswald's dilution law its uses and limitations.

**Unit IV**

Polymer Science

Historical Background, general concepts, properties, addition & condensation polymers, preparation of polymer solution, Pharmaceutical Application of Polymers.

**Unit V**

Statistical thermodynamics: Boltzmann distribution: Kinetic theory of gases: partition functions and their relation to thermodynamic quantities-calculation for model system.

**Books recommended:-**

1. Martins- Physical Pharmacy and Pharmaceutical Sciences, Patrick J. Sinko, Lippincot Williams and Wilkins.
2. Textbook of Physical Pharmaceutics, CVS Subrahmanyam, Vallabh Parkashan, New Delhi.
3. Physical Chemistry, P.W. Atkins, ELBS.
4. Chemical Kinetics, K.J. Laidler, McGraw-Hills  
Kinetics and Mechanism of Chemical Transformation J. Rajaraman and J. Kuriacose, Mc Millan.
5. Text Book of Polymer Science, Fred. W. Billmeyer, 3rd edition, Wiley Interscience Publication, John Wiley and Sons.
6. Introduction to Polymers Sciences and Technology, S.D. Dawande, 1st edition, Denett and Co., Nagpur.
7. Polymer Science, V.R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, New Age International, New Delhi.
8. Polymers in Drug Discovery, Ijeoma F. Vihegbu, Andreas G. Schatzlein, Taylor and Francis.
9. Biodegradable hydrogels for drug delivery, Kinam Park, Waleed S.W. Shalaby, CRC Publisher.
10. Organic Chemistry, I.L. Finar, Vol.-I and II, 6th Edition, Pearson Education Asia.
11. Chemistry of Natural Products, S.V. Bhat, B.A. Nagasampegi, M. Sivakumar, Springer Publication.
12. Glycopeptides and Glycoproteins, Synthesis, structure and Applications Volume Edition, V. Whitmann, Springer Publications.
13. Current Science, Vol.-91, No.5, 10th September 2006.
14. New J.Chem., 2008, Royal Society of Chemistry, 2008.

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15. Perfect Symmetry, Jim Baggott, 1994, Oxford University Press.

16. Charles E. Carraher Jr ' Polymer Chemistry sixth edition, Marcel Dekker Inc. New York.

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**Pharmaceutical Chemistry Paper V**  
**PC -205 COMPUTERS FOR CHEMISTS**

**Unit I**

Introduction to Computers, development & generation of computers, input & output devices, data representation in computers.

**Unit II**

Basic structure and functioning of computers with a PC as an illustrative example, Memory I/O devices, Secondary storage, Computer languages, Operating systems with DOS as an example, Architecture of seven layers of communication

**Unit III**

Computer application in pharmaceuticals and clinical studies, Chemdraw, Chem-3D, Maestro, Docking programs.

**Unit IV**

Use of Computer Programmes

The students will learn how to operate a PC and how to run standard programmes and packages such as MS Word, MS Excel. Execution of linear regression X-Y plot numerical integration and differentiation as well as differential equation solution programmes.

**Unit V**

Application of Internet of chemistry with search engines, various types of files like PDF, JPG, RTF and Bitmap, Scanning, OMR, Web camera.

**Book Recommended:**

1. Fundamentals of Computer: V. Rajaraman (Prentice Hall)
2. Computer in Chemistry: K.V. Raman (Tata Mc Graw Hill)
3. Computer Programming in FORTON IV: V. Rajaraman (Prentice Hall)

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**SEMESTER SECOND**  
2015-16  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Practical Syllabus**

**Second Semester Practical's**

- 1) Fisher indole synthesis.
- 2) Friedal Craft reaction.
- 3) Standardization of Analytical weight and Calibration of volumetric apparatus.
- 4) Thin layer chromatography of amino acids.
- 5) Extraction of some phyto-constituents of Different herbal Drugs by Soxhlet extraction.
- 6) UV-visible determination of some official formulations for Assay (percentage purity) and related substance.
- 7) Interpretation of Some Unknown Infrared and NMR spectra.
- 8) Acid-Base Titration.
- 9) Determination of solubility and surface tension.
- 10) Preparation of Calamine lotion.
- 11) Preparation of Turpentine Liniment.
- 12) Preparation of Compound Sodium Chloride Mouthwash.
- 13) Preparation of Antacid.
- 14) Software lab to be used for the following: -MS office, MS word, MS PowerPoint, MS Excel.
- 15) Computer operating system.
- 16) Internet feature (Email browser).
- 17) Separation and Identification of components from binary or ternary organic mixture.

**SEMESTER SECOND**  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Examination scheme**

**Duration -8 Hours**

**Total Marks -100**

**Minimum Passing Marks-33**

**Examination scheme: - Second semester**

- |                                              |            |
|----------------------------------------------|------------|
| 1) Fisher indole synthesis                   | (10 marks) |
| 2) Acid Base Titration's.                    | (15 marks) |
| 3) Component separation using TLC.           | (10 marks) |
| 4) Preparation of Calamine Lotion            | (10 marks) |
| 5) Preparation of Turpentine Liniment.       | (10 marks) |
| 6) Preparation of Sodium Chloride Mouthwash. | (10 marks) |
| 7) Software lab.                             | (10 marks) |
| 8) Viva-Voce                                 | (15 marks) |
| 9) Practical Record                          | (10 marks) |

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**SEMESTER THIRD**  
**2015-16**  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Syllabus**

**Pharmaceutical Chemistry Paper I**

**PC -301 PRINCIPLES OF PHYSICAL PHARMACY-III**

**Unit I**

Colloids

Introduction: Types of Colloidal system, Optical Properties of Colloids, Kinetic Properties of Colloids, Electric Properties of Colloids, Solubilization, thermodynamics of Micellization.

**Unit II**

Diffusion and Dissolution

Steady- State Diffusion, Procedure and Apparatus, Dissolution, Drug Release, Drug in polymer matrix, release from granular matrices, multiplayer diffusion membrane control and diffusion layer control, Thermodynamic of diffusion, Fick's Second Law.

**Unit III**

Catalysis- Characteristics of catalysed reactions classification of catalysts acid - base catalysis, kinetics of enzyme catalysed reactions, Decomposition and Stabilization of Medicinal Agents, Photo degradation, Accelerated Stability Analysis.

**Unit IV**

Chemical bonding in Diatomic: elementary concepts of MO and VB theories: Huckel theory for conjugated  $\pi$ - electron system

**Unit V**

Basic of solubility in different states of matter, partition coefficient, phase rule, determination of degree of dissociation of acid and base.

**Book Recommended:**

1. Martins- Physical Pharmacy and Pharmaceutical Sciences, Patrick J. Sinko, Lippincot Williams and Wilkins.
2. Textbook of Physical Pharmaceutics, CVS Subrahmanyam, Vallabh Parkashan, New Delhi.
3. Physical Chemistry, P.W. Atkins, ELBS.

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**Pharmaceutical Chemistry Paper II**  
**PC -302 PRINCIPLES OF PHARMACOGNOSY**

**Unit I**

- (A) Introduction to pharmacognosy, Contribution of pharmacognosy in modern medicine. Present status and future trends in pharmacognosy.
- (B) Natural Sources of drugs: - Higher plants, microbes, animals, and marine organisms. Classification of drugs from natural origin: Morphological, taxonomical, pharmacological (therapeutically), chemical classification.

**Unit II**

Primary & secondary metabolites, basic metabolic pathways, Shikmink acid pathway, Acetate pathway, Mevalonic acid pathway

**Unit III**

**Carbohydrate-** Classification Isolation of a carbohydrate drug, Identification Characterization & Pharmacognostic study of Isapgol, Acacia, Dextran,

**Glycoside drug-** Classification Isolation of a Glycoside drug Biological Significant of Glycoside drug, O- Glycoside, Medicinally Important Glycoside Anthraquinon Glycoside (Seena Leaf and Fruit), Flavonoid Glycosides, Cardiac Glycoside, (Ditoxin Digitalis)

**Unit IV**

**Alkaloid drugs-** Classification Isolation of Alkaloid drug Identification Characterization & Pharmacognostic study of Rauwolfia, Opium, Belladonna Herb, Cinchona,

**Unit V**

**Terpens-** Classification and Isolation of Terpens drug Identification Characterization & Pharmacognostic study of Eucalyptus oil, Turpentine oil, Pepeeerment oil,

**Books Recommended:-**

1. Trease and Evans, Pharmacognosy, 15th edition, Elsevier.
2. Pharmacognosy, S.B. Gokhle, C.K. Cokate, Nirali Publication.
3. Fundamentals of Pharmacognosy and Phytotherapy, Michel Heinrich, Joanne Barner, Churchill Livingstone

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## Pharmaceutical Chemistry paper III

### PC-303 PHARMACEUTICAL MEDICINAL CHEMISTRY-I

#### Unit I

##### Central Nervous System depressants:

- (A) General anesthetics: General Discussion, Inhalation, ultra short acting barbiturates, dissociative anesthetics such as cyclopropane, halothane, nitrous oxide, chloroform, thiopental sodium, tribromoethanol.
- (B) Local anesthetics: Discussion, classification Mechanism of action, structure, properties, synthesis, therapeutic application, side effect and doses Benzoic acid derivatives procaine, lignocaine, eucaine, cocaine and benzocaine.

#### Unit II

(A) Anxiolytic, Sedatives, hypnotics- Classification, Structure Activity Relationship (SAR) and synthesis of Barbiturates. Structure, synthesis, mode of action, therapeutic application, side effect and doses of following drugs- Allobarbital, Hexobarbital, pentobarbital.

(B) Anticonvulsant- Classification of anticonvulsant drug, structure, synthesis, therapeutic application, side effect and doses of following drugs- phenobarbital, phenytoin sodium.

#### Unit III

Adrenergics and Antiadrenergic system and drugs- Classification, Mechanism of action, structure, properties, synthesis, therapeutic application, side effect and doses of following drugs- Adrenaline, Isoprenaline, Phenoxy benzamine, Nephazoline.

#### Unit IV

Cholinergics and Anticholinergics system and drugs- SAR of Cholinergic Agonist, Classification Mechanism of action, structure, properties, synthesis, therapeutic application, side effect and doses of following drugs- Acetyl Choline, Echothiophate iodide

#### Unit V

(A) Analgesics, Antipyretics and Anti-inflammatory agents:- Classification and SAR of analgesic & Antipyretic drugs. Mode of action & SAR of morphine & its analogues. Structure, synthesis, mechanism of action, side effects and doses of following drugs- Mefenamic acid, Ibuprofen, Paracetamol, Phenyl butazone & aspirin.

#### Books Recommended:-

1. Medicinal Chemistry by Kadam and Bothra.
2. Medicinal Chemistry by Ashutosh kar.
3. Medicinal Chemistry by Berger.
4. Medicinal Chemistry- W. O. Foye.
5. Organic Medicinal Chemistry- Wilson & Gisvold.
6. Organic Chemistry, I.L. Finar, Vol.-I and II, 6th Edition, Pearson Education Asia.
7. Chemistry of Natural Products, S.V. Bhat, B.A. Nagasampegi, M. Sivakumar, Springer Publication.

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**Unit-I**

Calcium and iron compounds as Pharmaceutical agents :- Calcium acetate, Calcium gluconate, Calcium hydroxide, Calcium lactate, Ferric ammonium citrate, Ferrous fumarate, Ferrous gluconate, Ferrous sulphate .

**Unit-II**

(A) Diagnostic drugs, Antithyroid drugs, Disinfectants.

(B) Major intra and extra cellular electrolytes, physiological acid base balance, electrolytic combination therapy.

**Unit-III**

Coordination Chemistry I

Stability of complexes; thermodynamic aspects of complex formation; factors affecting stability, Determination of stability constants by spectrophotometric, polarographic and potentiometric methods.

**Unit-IV**

Coordination Chemistry II and Macrocyclic Ligands

Macrocyclic ligands; types; porphyrins; corrins, Schiff bases; crown ethers; crypts. Crystal field theory and its limitations, d-orbital splittings, LFSE, spectro chemical Series

**Unit-V**

Radiopharmaceuticals

Basic properties, production, quality control, stability, clinical and medicinal applications of radioisotopes used in pharmacy and medicine preparations of diagnostic and therapeutic agents.

**Books Recommended:-**

1. J.E. Huheey, Inorganic Chemistry - Principles, Structure and Reactivity, Harper Collins, New York, IV Edition (1993)
- 2 F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry - A Comprehensive Text, John Wiley and Sons, V Edition (1988)
- 3 K.F. Purcell and J.C. Kotz, Inorganic Chemistry - WB Saunders Co., USA (1977)
- 4M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., New York (1974)
- 5J.E. Huheey, Inorganic Chemistry, Harper Collins NY IV Edition, (1993)
6. G.S. Manku, Inorganic Chemistry (1984)

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**Pharmaceutical Chemistry paper V**  
**PC -305 INSTRUMENTAL METHODS OF ANALYSIS**

**Unit I**

Nephelometry and Turbidimetry:- Theory of Nephelometry and turbidimetry, Instrumentation Single and double beam, Factors affecting measurements, applications of turbidimetry and nephelometry.

**Unit II**

Fundamentals of Potentiometry, Potentiometric Titrations (acid base titration, complexometric titration, oxidation reduction titration, precipitation titration) The Hydrogen electrode, the calomel electrode, the glass electrode

Polarography- Introduction, apparatus, factors affecting the limiting current and its applications

Karl Fisher titrations

**Unit III**

Amperometry- Principles, types of end points, amperometric titrations, apparatus, advantages and applications.

Fluorimetry- Introduction, theory, instrumentation and applications.

**Unit IV**

Basic principle, instrumentation and applications of Atomic absorption spectroscopy and Flame Photometry.

Basic principle, instrumentation and applications of X-Ray diffraction

**Unit V**

Basic principle, instrumentation and applications of Differential scanning calorimetry (DSC), Thermogravimetric analysis (TGA), Differential thermal analysis (DTA).

**Books Recommended:-**

1. Medicinal Chemistry by Ashutosh kar,
2. Foy'S Medicinal Chemistry
3. Bergers Medicinal Chemistry,
4. Drug Design By Patrick.
5. Vogel's Textbook of Quantitative Analysis.
6. Instrumental Method of Analysis by Gurdeep Chatwal.
7. Smith HJ, Williams H, eds, " Introduction to the principles of Drug Design" Wright Boston.
8. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.
9. Robert GCK, ed., " Drug Action at the Molecular Level" University Prak Press Baltimore.
10. Martin YC. "Quantitative Drug Design" Dekker, New York

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**SEMESTER THIRD**  
2015-16  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Practical Syllabus**

**Third Semester Practical's**

- 1) Studies of different type of colloids and their properties.
- 2) Shelf life determination and expiration dating of pharmaceuticals.
- 3) Morphology of turmeric, ginger, mentha.
- 4) Identification of Crude drugs.
- 5) Morphology and microscopy of clove, fennel, senna.
- 6) Microscopically measurement of starch grains.
- 7) General chemical test for alkaloids, glycosides, tannins, saponins, flavonoids.
- 8) Chemical test for acacia, tragacanth, agar.
- 9) Preparation of Vicks.
- 10) Preparation of Balm.
- 11) Preparation of Menthol Aqueous inhalation.
- 12) Determination of Stomatal index.
- 13) Preparation and Standardization of EDTA Solution.
- 14) Project work- Preparation of Herbarium sheet/ Pharmaceutical Museum.

**SEMESTER THIRD**  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Examination scheme**

**Duration -8 Hours**

**Total Marks -100**

**Minimum Passing Marks-33**

**Examination scheme: - Third semester**

- |                                                              |            |
|--------------------------------------------------------------|------------|
| 1) Microscopy of Clove.                                      | (10 marks) |
| 2) Identification and morphology of Crude drugs. (Any three) | (15marks)  |
| 3) PPN and standardization of EDTA Solution.                 | (15 marks) |
| 4) General chemical test for alkaloids.                      | (10 marks) |
| 5) Preparation of Vicks.                                     | (10 marks) |
| 6) Preparation of Aqueous Inhalation.                        | (10 marks) |
| 7) Viva-Voce                                                 | (15 marks) |
| 8) Practical Record                                          | (10 marks) |

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## Pharmaceutical Chemistry Paper I

### PC -401- PHARMACEUTICAL MEDICINAL CHEMISTRY-II

#### Unit I

(A) **Antihypertensive drugs:** Classification, Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs-Captopril, Propranalal Hydrochloride, Methyl dopa, Guanithidine.

(B) **Diuretics:** Classification, Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs  
Hydrochlorothiazide, Hydroflumethiazide, Ethacrynic acid, Furosemide, Acetazolamide

#### Unit II

**Central Nervous System Stimulants:** Classification, Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs- Xanthene derivative -caffeine , theophylline , theobromine. Analeptic drug- Nikethamide, Pentetrazol.

#### Unit III

**Chemotherapy:** Classification, Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs- mechlorethamine, chlorambucil, Uracil mustard , Cyclophosphamide.

#### Unit IV

**Sulphonamides:** Classification, Structure activity Relationship (SAR) , Mechanism of action of suphonamides, structure, synthesis and use of sulphacetamide, suphaguianidine, sulphadimidin, Mefenide.

#### Unit V

(A) **Antitubercular drugs:** Structure, synthesis, mechanism of action, therapeutic application, side effect and doses of following drugs: Ethambutol, Isoniazid, Rifampicin, Streptomycin.

(B) **Gastrointestinal drugs, Drugs for Peptic ulcer:** Antacid, Aluminium hydroxide gel, Calcium carbonate, Magnesium carbonate, Milk of magnesia.

#### Books Recommended:-

1. Foye W, "Principles of Medicinal Chemistry" Lea & Febiger.
2. Delgado J.N., Remers WA eds, "Wilson & Giswolds Text Book of organic Medicinal & Pharmaceutical chemistry" Lippincott, New York.
3. Monographs and relevant review articles appearing in various periodicals and journals.
4. Alex Gringauz- "Introduction to Medicinal Chemistry" Wiley-VCH, Inc. New York.
5. Abraham DJ, ed., Burger's Medicinal Chemistry & Drug Discovery, Vol-I-VI, John Wiley & sons, New Jersey.
6. Medicinal Chemistry by Ashutosh kar,
7. G. L. Patric- Medicinal Chemistry.

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## Pharmaceutical Chemistry Paper II

### PC – 402 DRUG DESIGN AND MEDICINAL CHEMISTRY

#### Unit I

**Structure and activity:** Relationship between chemical structure and biological activity (SAR) , Receptor site Theory. Approaches to drug design . Introduction to Combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR- Free – Wilson analysis , Hansch analysis , relationship between Free- Wilson Analysis and Hansch analysis

#### Unit II

**Pharmacodynamics:** Introduction , elementary treatment of enzymes stimulation ,enzyme inhibition , sulphonamides , membrane active drugs , drug metabolism , xenobiotics , biotransformation , significance of drug metabolism in medicinal chemistry.

#### Unit III

**Antibiotics and antibacterials:** Introduction , Antibiotic B- Lactam type – Penicillins , Cephalosporins , Antitubercular – Streptomycin , Broad spectrum antibiotics –Tetracycline , Anticancer – Dactinomycin (Actinomycin D)

#### Unit IV

**Antifungal** –Polyenes ,Antibacterial- Ciprofloxacin , Norfloxacin, Antiviral – Acyclovir

**Antimalarials :** Chemotherapy of malaria. SAR, Chloroquine ,Chloroguanide and Mefloquine

#### Unit V

**Non- steroidal Anti-inflammatory Drugs :** Diclofenac Sodium , Ibuprofen and Netopam

**Antihistaminic and Antiasthmatic Agents :** Terfenadine, Cinnarizines , Salbutamol and Beclomethasone dipropionate

#### Book Recommended:-

1. Trease and Evans, Pharmacognosy, 15th edition, Elsevier.
2. Burger's Medicinal Chemistry, 6th edition, Vol-I, Wiley Interscience, New York.
3. Chemistry of natural products by S.V.Bhat, B.A.Nagasampegi, Springer publications. New York.
4. Finar, Organic Chemistry, Vol-I
5. Drug Discovery and Evaluation, Pharmacological assays. H.Gerhard Vogel, 2nd edition, Springer publications,
6. Quality Control of Herbal drugs, An approach to evaluation of botanicals, by PulokMukherjee, Business Horizon Publications.
7. Pharmacognosy and Pharmacobiotechnology, by Ashutosh Kar, New age International publications

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### Unit I

Pericyclic reactions- electrocyclic, cycloaddition, sigmatropic rearrangements and other related concerted reactions, principle and applications of photochemical reactions in organic chemistry.

### Unit II

Chemical Kinetics and Elements of Group Theory

Acid - Base catalysis - mechanism of acid - base catalysed reactions - Bronsted catalysis law.

Symmetry elements and symmetry operations- group, multiplication table, sub groups, similarity transformation and classes - identifications of symmetry operations and determination of point groups - reducible and irreducible representations.

### Unit III

Applications of Group Theory

Orthogonality theorem and its consequences - construction of character table for  $C_{2v}$  and  $C_{3v}$  - hybrid orbitals in non linear molecules ( $H_2O$ ,  $CH_4$ ,  $XeF_4$ ,  $BF_3$ ,  $SF_6$  and  $NH_3$ ).

Determination of representations of vibrational modes in non linear molecules ( $H_2O$ ,  $CH_4$ ,  $BF_3$ , and  $NH_3$ ),

Symmetry selection rules for infra-red and Raman spectra, application of group theory for the electronic spectra of ethylene and formaldehyde.

### Unit IV

Organometallic compounds: synthesis, bonding and structure, and reactivity, Nuclear Chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

### Unit V

Organic Transformations and reagents: Functional group interconversion including oxidation and reduction; common organic reagents- Lithium Aluminium Hydride, Osmium tetra oxide, Lead tetra acetate, organomagnesium,  $HIO_4 \cdot O_3$ , organolithium, organozinc, organomercury, organocadmium compounds, Chemo, regio and stereoselective transformation.

### Book Recommended:-

1. Sethi, P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
2. Kemp William, Organic spectroscopy, Pal grave, New York.
3. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi.
4. Gross - Mass Spectrometry
5. WHO - Quality Assurance of Pharmaceuticals, Vol. I, II.
6. Sethi, P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
7. Sethi, P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
8. Haffmann, Chromatography.
9. Sethi and Charegankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
10. Robert D. Braun, Introduction to Instrumental Analysis.
11. Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry.
12. Harry G. Brittain, Spectroscopy of Pharmaceutical Solids.
13. George, S., Steroid Analysis in Pharmaceutical Industry.

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## Pharmaceutical Chemistry Paper IV

### PC – 404 FOOD SUPPLEMENTS, ADDITIVES AND TOXICOLOGY

#### Unit I

(A) Historical and dietary importance of vitamins A, B complex, C, D, E, K and minerals, Biological role of vitamins and minerals.

(B) Artificial sweeteners, their availability, regulation of use and potential toxicity.

#### Unit II

(A) E- numbers and their use in classifying food additives.

(B) Fluoride in toothpaste and water supplies and the implications in supplementation of diet.

(C) Salt and monosodium glutamate in processed foods, and the implications for health.

#### Unit III

(A) Definition and types of toxicology, Basic principles of toxicology. Drugs and pregnancy.

(B) Drugs addiction and drug dependence, drug abuse,

(C) Toxicology and treatment of Drugs such as salicylates, paracetamol. Opium, quinine, ethyl alcohol, nicotine, digitalis, barbiturates etc.

(D) Toxicology and treatment of metals such as lead. Aluminium, mercury, arsenic, antimony etc.

#### Unit IV

(A) The role of herbal supplements in the diet

(B) Marketed preparations that are used as a supplement in various diseases like diabetes, arthritis, hypertension etc.

#### Unit V

General treatment of different types of pollution such as Air pollution, water pollution and noise pollution.

#### Books Recommended:-

1. Food Additives- A. Larry Branen, P. Michel Davidson, Eastern Hemisphere Distributors.
2. Toxicology- Gary D. Osweiler, Lippincott Williams and Wilkins.
3. P S Kalsi, Organic reactions and their mechanism.
4. March, J., Advanced Organic Chemistry, Reaction Mechanism and Structure, John Wiley and sons, New York.

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## Pharmaceutical Chemistry Paper V

### PC-405<sup>2</sup> DRUG PHARMACOKINETICS AND DRUG DEVELOPMENT

#### Unit I

Drug Targets – Nature and mechanism of functioning of drug targets: - Enzymes, receptors, proteins, nucleic acids.

#### Unit II

Pharmacokinetics: - Introduction

(A) Drug absorption: - Introduction, cell membrane, drug solubility.

(B) Drug distribution: - Introduction, distribution around the blood supply, distribution to tissues, distribution to cells, other distribution factors, blood brain barrier, placental barrier.

#### Unit III

Pharmacokinetics

(a) Drug excretion: - Definition, lungs, the bile duct, other routes and the kidneys.

(b) Drug Administration: Definition, oral administration, mucous membranes, Rectal, inhalation, topical, injection, subcutaneous implants.

(c) Drug dosing: - Dosing, drug-half life, steady-state concentration, drug tolerance

#### Unit IV

Biological testing and bioassays – drug testing, drug testing in vitro, drug testing in vivo.

Drug Dissolution & disintegration, apparatus and uses.

#### Unit V

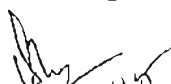
Structure activity relationships: - Definition & importance

(A) Binding Interaction (Drug target) with one example of each type- ionic bonding, hydrogen bonding, Vander walls interaction, Dipole-dipole interactions and covalent bonds.

(B) Functional groups as binding groups:- Alcohols and phenols, amines, aldehydes and ketones and Carboxylic acids.

#### Books Recommended:

1. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
2. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.
3. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
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**SEMESTER FOURTH**  
**2015-16**  
**M.Sc (Drugs and Pharmaceutical Chemistry)**  
**Practical Syllabus**

***Fourth Semester Practical's***

- 1) Synthesis of Organic Compound.
- 2) Isolation of caffeine from tea leaves.
- 3) Isolation of Starch from potato.
- 4) Chemical test of tea.
- 5) Extraction of active constituents from extraction method.
- 6) Preparation and standardization of titrants like silver nitrate.
- 7) Preparation and standardization of redox titrants.
- 8) Preparation of Borax Cold Cream.
- 9) Preparation of Suppositories.
- 10) Preparation of Calcium Carbonate Paste.
- 11) Preparation of Talcum Powder.
- 12) Preparation of Coconut oil Shampoo.
- 13) Preparation of Lipsticks.
- 14) Project work- a report on marketed preparations based on traditional drugs mentioned in theory.

**SEMESTER FOURTH**  
**M.Sc. (Drugs and Pharmaceutical Chemistry)**  
**Examination scheme**

**Duration -8 Hours**

**Total Marks -100**  
**Minimum Passing Marks-33**

***Examination scheme: - Fourth semester***

- |                                             |            |
|---------------------------------------------|------------|
| 1.) Synthesis of organic compound.          | (10 marks) |
| 2.) Isolation of starch from potato.        | (10 marks) |
| 3.) Isolation of caffeine from tea leaves   | (10 marks) |
| 4.) Preparation of Calcium Carbonate Paste. | (15 marks) |
| 4) Preparation of Talcum Powder.            | (10 marks) |
| 5.) Preparation of Lipsticks.               | (10 marks) |
| 6.) Preparation of Suppositories.           | (10 marks) |
| 7.) Viva-Voce                               | (15 marks) |
| 8.) Practical Record                        | (10 marks) |

*Wg*  
7/7/15

*Sue*

*Kid*

*Man*

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