

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.PHARMACY (PHARMACEUTICAL CHEMISTRY)**  
**R25 COURSE STRUCTURE AND SYLLABUS**  
**Effective from Academic Year 2025 - 26 Admitted Batch**

**I YEAR I Semester**

Course Code	Course Title	L	T	P	Credits
Professional Core-I	Advanced Organic Chemistry-I	3	1	0	4
Professional Core-II	Advanced Medicinal Chemistry-I	3	1	0	4
Professional Elective-I	1. Chemistry of Natural Products 2. Modern Pharmaceutical Analytical Techniques 3. Drug Regulatory Affairs	3	1	0	4
Professional Elective-II	1. Drug Discovery & Design 2. Pharmaceutical Food Analysis 3. Spectral Analysis	3	1	0	4
	Research methodology and IPR	2	0	0	2
Laboratory-I	Advanced Organic Chemistry – I Lab	0	0	6	3
Laboratory-II	Advanced Medicinal Chemistry – I Lab	0	0	6	3
Audit - I	Audit Course – I	2	0	0	0
	Seminar & Assignment	0	0	4	2
	<b>TOTAL</b>	<b>16</b>	<b>4</b>	<b>16</b>	<b>26</b>

**I YEAR II Semester**

Course Code	Course Title	L	T	P	Credits
Professional Core-III	Advanced Organic Chemistry –II	3	1	0	4
Professional Core-IV	Advanced Medicinal Chemistry - II	3	1	0	4
Professional Elective-III	1. Pharmaceutical Process Chemistry 2. Quality Control and Quality Assurance 3. Clinical Research and Pharmacovigilance	3	1	0	4
Professional Elective-IV	1. Screening Methods in Pharmacology 2. Advanced Instrumental Analysis 3. Herbal Drug Technology	3	1	0	4
Laboratory-III	Advanced Organic Chemistry - II Lab	0	0	6	3
Laboratory-IV	Advanced Medicinal Chemistry - II Lab	0	0	6	3
	Mini project	2	0	0	2
Audit - II	Audit Course - II	2	0	0	0
	Seminar & Assignment	0	0	4	2
	<b>TOTAL</b>	<b>16</b>	<b>4</b>	<b>16</b>	<b>26</b>

**II YEAR I Semester**

Course Code	Course Title	L	T	P	Credits
Professional Elective-V	1. Biostatistics 2. Pharmaceutical Production and Packaging Technology 3. Scale-up and Technology Transfer	3	1	0	4
Open Elective	Open Elective	3	1	0	4
	Comprehensive Viva Voce	0	0	8	4
	Dissertation Work Review - II	0	0	24	12
	<b>Total Credits</b>	<b>6</b>	<b>2</b>	<b>32</b>	<b>24</b>

**II YEAR II - SEMESTER**

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review - III	0	0	24	12
Dissertation	Dissertation Viva-Voce	0	0	20	10
	<b>Total Credits</b>	<b>0</b>	<b>0</b>	<b>44</b>	<b>22</b>

**\*For Dissertation Work Review - I, Please refer R25 Academic Regulations.**

**Audit Courses I & II:**

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technological Learning
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development Through Life Enlightenment Skills

**Open Electives:**

1. Entrepreneurship Management
2. Pharmaceutical administration
3. Cosmetic Science
4. Environmental and Health safety
5. Vaccines and Biologicals

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**ADVANCED ORGANIC CHEMISTRY – I (Professional Core – I)**

**Course Objectives:** The course structure is designed to give the knowledge of organic chemistry at an advanced level and mainly aimed at the stereochemistry and different organic named reactions including preparations of reactive intermediates.

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Explain the concepts of chirality, optical activity and stereoisomerism, and determine configurations (R/S, E/Z), resolution of organic molecules.
- CO 2. Identify and compare different reactive intermediates and evaluate the concepts of aromaticity, antiaromaticity, and non-benzenoid systems.
- CO 3. Illustrate the mechanisms of free radical, electrophilic, and nucleophilic reactions in aliphatic and aromatic compounds.
- CO 4. Differentiate between elimination mechanisms (E1, E2, E1CB) and analyze factors influencing reactivity and orientation in elimination and addition reactions.
- CO 5. Describe the types and mechanisms of pericyclic reactions such as electrocyclic, cycloaddition, and sigmatropic rearrangements with examples.

**UNIT I**

- a. Stereochemistry: a. Elements of symmetry, simple axis of symmetry. Notation, relative configuration and absolute configuration. Compounds with a chiral carbon atom, compounds with other quadrivalent chiral atoms. Optical isomerism in compounds containing no chiral atom, biphenyl, allenes, compounds with exocyclic double bonds and spirans.
- b. Chirality due to helical shape. cis / trans, E – Z isomerism resulting from double bonds, monocyclic compounds, fused ring system. Racemic modifications and methods for resolution of racemic mixtures. Asymmetric synthesis and stereo – selective synthesis.

**UNIT II**

- a. Reactive Intermediates: Definitions, generation, stability, structure and reactivity of free radicals carbocations, carbanions, carbenes, Nitrenes/Nitrenium ions.
- b. Concepts of aromaticity and antiaromaticity, non-benzenoid aromatic compounds.

**UNIT III**

**Mechanisms of organic reactions:** Free radical, Electrophilic, Nucleophilic reactions of aliphatic and aromatic compounds

**UNIT IV**

**Elimination Reactions:** E<sub>1</sub>, E<sub>2</sub>, E<sub>1CB</sub> and E<sub>2CB</sub> mechanisms, Mechanisms and orientation in pyrolytic eliminations, effect of substrate structure, attacking base, leaving group and reaction bond, medium and reactivity addition to carbon – carbon multiple bond reactions. Mechanisms, Orientation and reactivity.

**UNIT V**

**Electrocyclic, pericyclic and sigmatropic reactions:** Introduction, terminology and mechanism, with suitable examples.

**TEXT BOOKS:**

1. Francis A. Carey & Richard J. Sunberg, Advanced Org. Chemistry, III rd Edition, Par B; Reactions and synthesis, Plenum Press, New York, London, Latest Edition.
2. Eliel I. Ernest and Samuel h, Stereochemistry of Org. Compounds, John Wiley and sons,.
3. Organic Chemistry, V Algarsamy, Pharmamed Press.

4. Roland E. Lehr & Alan P Marchard, Orbital Symmetry: A Problem-Solving approach, Academic Press, New York Latest Edition.
5. J. March, Advanced Org. Chemistry, Reactions Mechanisms and Structure, 4<sup>th</sup>
6. Edition, John Wiley & Sons, New York Latest Edition
7. I. L. Finar, Organic Chemistry, ELBS
8. Herbert O. Modern Synthesis Reactions II<sup>nd</sup> Edition W.A. Beenamis Inc. Menco Park California
9. W. Carruthers, Some Modern Methods of Org. Synthesis, III<sup>rd</sup> Edition, Cambridge University Press, Cambridge.

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**ADVANCED MEDICINAL CHEMISTRY – I (Professional Core – II)**

**Course Objectives:** The course contents are mainly aimed to have advanced knowledge of rational drug design including QSAR and molecular modeling and also aimed at the identification of lead molecule from natural sources for the development of new drugs.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain the process of lead molecule discovery and describe methods for identifying and validating drug targets.
- CO 2. Apply QSAR principles and models such as Hansch and Free Wilson analyses to correlate chemical structure with biological activity.
- CO 3. Utilize computer-aided drug design tools, including virtual screening and molecular modeling, for structure- and pharmacophore-based drug design.
- CO 4. Discuss the role of natural products in drug discovery and outline approaches for identifying and optimizing bioactive natural compounds.
- CO 5. Analyze the structural basis of drug design for specific biological targets relevant to diseases like HIV and cardiovascular disorders.

#### **UNIT I**

**Modern methods of Drug Discovery target validation:** Introduction to discovery of lead molecule, methods, rational drug discovery models. Target structure, active site identification and methods of validation.

#### **UNIT II**

**Rational Drug Design:** QSAR: Parameters involved in QSAR, lipophilicity (Polarisability, electronic and steric parameters). Quantitative models. Hansch Analysis, Free Wilson Analysis and their relationships, linear relationships and applications of Hansch and Free Wilson Analysis.

#### **UNIT III**

a. **Computer aided drug design (CADD):**

**Virtual screening:** concept, drug likeness screening, focused screening libraries for lead identification, pharmacophore screening, structure based virtual screening and applications.

**Molecular modeling:** Molecular mechanics, quantum mechanics, modeling ligands for known receptors and unknown receptors.

b. **Drug Design:** Introduction, Pharmacophore – based drug design, Known receptors, structure – based drug design, homology modeling, unknown receptors.

#### **UNIT IV**

**Natural Products as Leads for New Drugs:** Introduction/History, approaches to discovery and development of natural products as potential new drugs, selection and optimization of lead compounds for further developments from CNS, anticancer antibiotics and cardiovascular drugs.

#### **UNIT V**

**Structure based drug design:** Inhibitors of HIV-1 Prokinase, Structural studies of HIV-1 Reverse transcriptase and implications for drug design, Bradykinin receptor antagonists, Design of purine nucleoside and Phosphorylase inhibitors, Aldose Reductase Inhibitors, Thrombin inhibitors. Rhinoviral-Capsid-binding Inhibitors.

#### **TEXT BOOKS:**

1. Berger's Medicinal Chemistry and Drug Design. 6<sup>th</sup> Edition.
2. Korolkovas Essentials of Medicinal Chemistry

3. Purcell Strategies of Drug Design
4. Corwin, Hansen Comprehensive Medicinal Chemistry
5. William O Foye Medicinal Chemistry
6. Structure based Drug Design by Pandi Veerapandion.
7. Stenlake, Foundation of Molecular Pharmacology- Pharma Med Press, volume I &II
8. Advanced Medicinal Chemistry: A Laboratory Guide, M. Raghu Prasad, A. Raghuram Rao

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**CHEMISTRY OF NATURAL PRODUCTS (Professional Elective – I)**

**Course Objective:** The contents of Unit I mainly aimed to identify lead molecules from the natural sources. The contents of Unit II & III are mainly designed to have the knowledge of alkaloids and steroids especially structural elucidation of few important compounds. The contents of Unit IV and V are to offer an understanding of utilization of natural products for the preparation of new molecules for the treatment of different diseases like cancer, malaria etc.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Discover how natural products are developed into new drugs like antibiotics.
- CO 2. Learn structures and uses of alkaloids like morphine and vincristine.
- CO 3. Study steroids like cholesterol for anti-inflammatory and antifertility uses.
- CO 4. Explore separation and synthesis of polypeptides, proteins, and insulin.
- CO 5. Analyze medicinal compounds like taxanes and artemisinin for therapeutic uses.

**UNIT I**

**Natural products as leads for new drugs:** Introduction/history, approaches to discovery and development of natural products as potential new drugs selection and optimization of lead compounds for further development with suitable examples from antibiotics, CNS, and cardiovascular agents.

**UNIT II**

**Alkaloids:** Introduction and general methods of structure elucidation.

From opium: morphine-structure elucidation, development of morphine analogues and morphine antagonists.

From Rauwolfia: Reserpine-structure elucidation, structural modifications and uses.

From vincarosea: vincristine and vinblastine - structural modification, semisynthetic derivatives and uses.

**UNIT III**

**Steroids:** Introduction, nomenclature, stereochemistry of steroids. Source and structure elucidation of cholesterol and diosgenin.

Structures, structure modifications and therapeutic uses of steroidal anti-inflammatory agents and antifertility agents.

**UNIT IV**

**Polypeptides and proteins:** introduction and general methods of separation, general methods of degradation and end group analysis, general methods of synthesis of peptides. Primary, secondary, tertiary and quaternary structure of proteins; chemistry of insulin.

**UNIT V**

**Compounds of medicinal Interest:** Structure, structural modifications, mechanism of action and therapeutic uses of a) taxanes b) camptothecin c) artemisinin e) ginkgolides and f) gymnemic acids.

**TEXT BOOKS:**

1. Finar IL. Organic Chemistry-stereochemistry and the chemistry of natural products. 5th ed. vol 2. Delhi: Dorling Kindersley (India) Pvt. Ltd., 2006.
2. Morrison RT, Boyd RN. Organic Chemistry. 6th ed. Delhi: Pearson education Pvt. Ltd., 2003.
3. Pelletier SW. Alkaloids-chemical & biological perspectives. vol 1-15. London: Pergamon; 2001.
4. Steroids by Fischer & Fischer.
5. Chemistry of Natural Products by Savita Kulkarni, Pharmamed Press.

6. Evans WC. Trease and evans pharmacognosy. 15<sup>th</sup> ed. Edinburgh: Saunders. 2004.
7. Ataur Rahman. Chemistry of natural products
8. Bhat SV, Nagasampagi BA, Sivakumar M. Chemistry of natural products. New Delhi: Narosa Publishing House; 2005.
9. Agrawal OP. Organic chemistry-natural products. 30th ed. vol 1-2. Meerut: Goel Publishing House; 2006.
10. Wallis TE. Textbook of pharmacognosy. 5th ed. New Delhi: CBS Publishers & Distributors; 2002.
11. Abraham DJ, editor. Burger's medicinal chemistry and drug discovery. 6th ed. vol 1-6, Singapore: John Wiley & Sons, 2007.
12. Lemke TL, Williams DA, Roche VF, Zito SW. Foye's principles of medicinal chemistry. 6<sup>th</sup> ed. New Delhi: Wolters Kluwer/ Lippincott Williams & Wilkins. 2008.
13. Block JH, Beale JM, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. 11th ed. Baltimore: Lippincott Williams & Wilkins; 2004.
14. Jerry M. Advanced organic chemistry-reactions, mechanisms, and structure. 4th ed. Kundli: Replika Press Pvt. Ltd; 2003.
15. Murray RK, Granner DK, Mayes PA, Rodwell VW. Harper's Illustrated biochemistry. 26th ed. New Delhi: Mc Graw Hill, 2003.
16. Rama Rao AVSS. A text book of biochemistry. 9th ed. Delhi: Rajkamal electric press, 2004.
17. Remington: The science and practice of pharmacy. 21st ed., vol. I & II, Lippincott Williams & Wilkins, New Delhi, 2005.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (Professional Elective – I)**

**Course Objective:** The course is designed to impart the knowledge in the field of Pharmaceutical Analysis. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics are taught to enable the students to understand and apply the principles involved in the determination of different bulk drugs and their formulation. In addition to the theoretical aspects, the basic practical knowledge relevant to the analysis is also imparted.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain the principles, procedures, and applications of column, thin-layer, and paper chromatography for qualitative and quantitative analysis.
- CO 2. Describe the principles, instrumentation, and pharmaceutical applications of gas chromatography, HPLC, and HPTLC.
- CO 3. Interpret UV-Visible and IR spectra by understanding their principles, instrumentation, and factors influencing absorption and vibration frequencies.
- CO 4. Explain the theory, ionization techniques, fragmentation patterns, and applications of mass spectrometry in structure elucidation.
- CO 5. Analyze NMR spectra to determine molecular structures by understanding chemical shifts, coupling patterns, and advanced techniques such as 2D-NMR and COSY.

**UNIT I**

**Introduction to chromatography and classification of chromatographic methods based on the mechanism of separation**

- a. **Column Chromatography:** Adsorption and partition, theory, preparation, procedure and methods of detection
- b. **Thin Layer Chromatography:** Theory, preparation, procedures, detection of compounds
- c. **Paper Chromatography:** Theory, different techniques employed, filter papers used, qualitative and quantitative detection

**UNIT II**

- a. **Gas chromatography:** Introduction, fundamentals, instrumentation, columns: preparation and operation, detection, derivatization.
- b. **HPLC:** Basic parameters, Principles and instrumentation, solvents and columns used, Operational modes, detection and applications of HPLC
- c. **HPTLC:** Theory and principle, instrumentation, elution techniques and pharmaceutical applications

**UNIT III**

- a. **UV-Visible spectroscopy:** Introduction, electromagnetic spectrum, absorbance laws and limitations, instrumentation-design and working principle, chromophore concept, auxochromes, Wood-Fisher rules for calculating absorption maximum, applications of UV-Visible spectroscopy
- b. **IR spectroscopy:** Basic principles -Molecular vibrations, vibrational frequency, factors influencing vibrational frequencies, sampling techniques, instrumentation, interpretation of spectra, FT-IR, theory and applications

**UNIT IV**

**Mass spectroscopy:** Theory, ionization techniques: electron impact ionization, chemical ionization, field ionization, fast atom bombardment, plasma desorption, fragmentation process: types of fission, resolution, GC/MS, **interpretation of spectra** and applications for identification and structure determination.

**UNIT V**

**NMR:** Theory, instrumentation, chemical shift, shielding and deshielding effects, splitting of signals, spin-spin coupling, proton exchange reactions, coupling constant(J), nuclear overhauser effect (NOE), <sup>13</sup>CNMR spectra and its applications, 2D-NMR, COSY and applications in pharmacy.

**REFERENCE BOOKS:**

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. A Text book of Pharmaceutical Analysis by Kerrenth A. Connors
5. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
6. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
7. Organic Chemistry by I. L. Finar
8. Organic spectroscopy by William Kemp
9. Quantitative Analysis of Drugs by D. C. Garrett
10. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
11. Spectrophotometric identification of Organic Compounds by Silverstein
12. HPTLC by P.D. Seth
13. Indian Pharmacopoeia 2007
14. High Performance thin layer chromatography for the analysis of medicinal plants by Eike Reich, Anne Schibli
15. Introduction to instrumental analysis by Robert. D. Braun
16. Theory and Practice of Chromatographic Techniques, Sanjay B. Bari By Pharmamed Press.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**DRUG REGULATORY AFFAIRS (Professional Elective – I)**

**Course Objective:** The topics which are present in the Drug regulatory affairs are very much useful which increases the knowledge regarding the regulatory aspects in the pharmaceutical industries.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain the structure and functions of Indian drug regulatory authorities and the Drugs and Cosmetics Act, including licensing and clinical trial requirements.
- CO 2. Describe the principles of GMP, ICH guidelines, and quality systems required for manufacturing and exporting pharmaceutical products.
- CO 3. Compare the regulatory frameworks and requirements governing drug development and approval in the USA, Europe, and Brazil.
- CO 4. Apply good documentation practices in manufacturing, quality control, and record-keeping to ensure product quality and regulatory compliance.
- CO 5. Identify major global regulatory authorities and outline their submission requirements for drug master files and product approvals.

**UNIT I**

**Drug Regulatory Aspects (India)**

- 1. Indian drug regulatory authorities, Central and State regulatory bodies (FDA)
- 2. Drugs and Cosmetics Act and Rules with latest Amendments (Selective)
- 3. Special emphasis – Schedule M and Y
- 4. New drugs – Importation, Registration, development, Clinical Trials, BE NOC & BE studies
- 5. Various Licences – Test Lic., Import lic., for testing of drugs and API's, Manufacturing Contract and Loan licence manufacturing.

**UNIT II**

**Good Manufacturing Practices (GMP)**

- 1. Indian GMP certification, WHO GMP certification.
- 2. ICH guidelines for stability testing and other relevant ones (Q1-Q10)
- 3. Export permissions and manufacturing for semi-regulated countries
- 4. Understanding of the plant layouts with special emphasis on the environment & safety (HVAC, Water Systems, Stores Management, Effluent etc.)
- 5. Quality Assurance and Quality Control – Basic understanding for in-built quality.

**UNIT III**

**Global Regulatory Affairs**

A detailed study of regulatory aspects that affect drug product design, manufacture and distribution in a developed country such as USA, Europe and Brazil, Hatch Waxmann Act; Bolar Provisions and other FDA Regulations. Regulatory aspects of pharmaceutical and bulk drug manufacture, regulatory drug analysis.

**UNIT IV**

**Good Documentation Practices**

Documentation related to manufacturing, cleaning methods, retention samples and records, quality control, batch release documents, distribution records, complaints and recalls.  
Quality, safety and legislation for cosmetic products and herbal products.

**UNIT V**

**Governing Regulatory Bodies across the globe.**

Country Authority Submission

- a. U.S Food & Drug Administration USDMF

- b. Canada Therapeutic Product DirectorateDMF
- c. Europe
  - 1) European Medicines Agency (EMA/ National Authorities) EDMF
  - 2) European Directorate for Quality of Medicines CEP/COS & Health Care Products.
  - 3) MHRA – Medicines and Health Care Products Regulatory Agency
- d. Product Filing
- e. Responding Regulatory Deficiencies
- f. Final Approval Procedure

Preparation, review and submission of Drug Master Files to Regulatory Authorities as per their specific requirements.

**TEXT AND REFERENCE BOOKS:**

1. Original laws published by Govt. of India.
2. Text Book of Forensic Pharmacy by Mithal B. M.; Vallabh Prakashan, New Delhi.
3. Laws of Drugs in India by Hussain.
4. Text Book of Forensic Pharmacy by Jain N. K.; Vallabh Prakashan, New Delhi.
5. Text Book of Forensic Pharmacy by C K Kokate, Pharmamed Press
6. Pharmaceutical Regulatory Affairs - Selected Topics, CVS Subramanyam and J Thimmasetty, Vallabh Prakashan Delhi - 2013

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**DRUG DISCOVERY AND DESIGN (Professional Elective – II)**

**Course Objective:** The topics are framed to enhance the student's knowledge in the various areas of molecular modelling, molecular docking, pharmacophore concepts, drug design techniques with detail concepts of all the mentioned areas.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain molecular modelling principles and analyze molecular properties using computational methods.
- CO 2. Apply pharmacophore mapping and 3D-QSAR techniques for identifying essential features of bioactive molecules.
- CO 3. Design drug molecules targeting key enzymes, receptors, and nucleic acids based on their biological functions.
- CO 4. Perform molecular docking and dynamics simulations to study drug–receptor interactions and binding energetics.
- CO 5. Utilize de novo design and informatics tools for structure-based drug discovery and active site analysis.

**UNIT I**

Molecular modelling: Molecular Mechanics, Quantum Mechanics, Energy minimization, geometry optimization, conformational analysis, global conformational minima determination; approaches and problems. Bioactive vs. Global minimum conformations. Automated methods of conformational search. Advantages and limitations of available software. Molecular graphics. Molecular properties, reactivity, Homo, LUMO, Electrostatic potential, Solvent accessible surface.

**UNIT II**

Pharmacophore concept: Pharmacophore mapping, methods of conformational search used in pharmacophore mapping. Comparison between the popular pharmacophore methods like Catalyst/HipHop, Disco Tech, GASP with practical examples, 3D QSAR Techniques.

**UNIT III**

Design of drugs for the following biological targets Agent acting on enzymes: DHFR, HIV-protease HMG-CoA Reductase, Phosphodiesterase, ACE, Transpeptidase,  $\beta$ -lactamase. Agents acting on receptors: PPAR, protein kinases. Agents acting on Nucleic acids: Topoisomerase, DNA and RNA polymerase, HIV-Reverse transcriptase

**UNIT IV**

Molecular docking: Rigid docking, flexible docking, manual docking. Advantages and disadvantages of Flex-X, Flex-S, Autodock and Dock softwares, with successful examples. Molecular dynamics: Dynamics of drugs, biomolecules, drug-receptor complexes, Monte Carlo simulations and Molecular dynamics in performing conformational search and docking. Estimation of free energy from dynamical methods.

**UNIT V**

De Novo drug design techniques: Receptor/enzyme cavity size prediction. Predicting the functional components of cavities, designing drugs fitting into cavity. Active site analysis structure – based drug design. Informatics methods in drug design: Informatics methods in drug design: Brief introduction to bioinformatics, cheminformatics.

**REFERENCE BOOKS:**

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.
3. Lien EJ. SAR "Side effects and Drug Design" Dekker, New York.

4. William H, MalickJB "Drug Discovery and Development" Humana Press Clifton.
5. Molecular Modelling, by A. R. Leach
6. Organic Chemistry of Drug Design and Drug Action, by R.B. Silverman
7. Practical Applications of computer aided drug design, by P.S. Charifson
8. Molecular modeling in Drug Design, by C. Cohen
9. Chemical Applications of Molecular modeling, by J. Goodman
10. Pharmacophore perception, by O. F. Guner
11. Current Concepts in Drug Design, T Durai Ananda Kumar, Pharma Med Press

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**PHARMACEUTICAL FOOD ANALYSIS (Professional Elective – II)**

**Course Objective:** This course is designed to impart knowledge on analysis of food constituents and finished food products. The course includes application of instrumental analysis in the determination of pesticides in variety of food products.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Understand various analytical techniques in the determination of Food constituents
- CO 2. Know various analytical techniques in the determination of Food constituents
- CO 3. Explain various analytical techniques in the determination of Finished food products
- CO 4. Describe various analytical techniques in the determination of Pesticides in food
- CO 5. Gain knowledge on food regulations and legislations

#### UNIT I

- a. **Carbohydrates:** Classification and properties of food carbohydrates, General methods of analysis of food carbohydrates,
- b. **Proteins:** Chemistry and classification of amino acids and proteins, Physico-Chemical properties of protein and their structure, general methods of analysis of proteins and amino acids

#### UNIT II

**Probiotics:** Definition, history, importance, mode of action, identification advantages and disadvantages of probiotics. Applications of Probiotics

#### UNIT III

**Lipids:** Classification, general methods of analysis, refining of fats and oils; hydrogenation of vegetable oils, Determination of adulteration in fats and oils.

#### UNIT IV

**Vitamins:** Classification of vitamins, methods of analysis of vitamins, Principles of microbial assay of vitamins of B-series

#### UNIT V

- a. **General Analytical methods** for milk, milk constituents and milk products like ice cream, milk powder, butter, margarine, cheese including adulterants and contaminants of milk.
- b. **Analysis of fermentation products** like wine, spirits, beer and vinegar.

#### TEXT BOOKS:

1. The chemical analysis of foods – David Pearson, Seventh edition, Churchill Livingstone, Edinburgh London, 1976
2. Introduction to the Chemical analysis of foods – S. Nielsen, Jones & Bartlett publishers, Boston London, 1994.
3. Official methods of analysis of AOAC International, sixth edition, Volume I & II, 1997.
4. Analysis of Food constituents – Multon, Wiley VCH.
5. Dr. William Horwitz, Official methods of analysis of AOAC International

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**SPECTRAL ANALYSIS (Professional Elective – II)**

**Course Objective:** The students will acquire the knowledge about the various aspects of X-Ray diffraction methods, all types of IR methods, particle sizing methods, also DSC, DTA, TGA etc

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain X-ray diffraction principles and apply crystallographic methods for structural elucidation.
- CO 2. Describe the principles and pharmaceutical applications of FT-NIR and ATR spectroscopy.
- CO 3. Explain the working and applications of potentiometric, amperometric, conductometric, and polarographic methods.
- CO 4. Apply spectrofluorimetry, flame emission, and atomic absorption techniques for drug analysis.
- CO 5. Understand FT-Raman principles and utilize its applications in pharmaceutical analysis and counterfeit detection

**UNIT I**

**X-Ray diffraction methods:** Origin of X-rays, basic aspects of crystals, X-ray crystallography, miller indices, rotating crystal techniques, single crystal diffraction, power diffraction, structural elucidation and applications.

**UNIT II**

- a) **FT-NIR:** Principle (overtones, combinations, fermi resonance, interferences etc.), instrumentation (dispersion spectrometer and FT-NIR), advantage and disadvantage, qualitative and quantitative applications, including PAT and non-destructive analysis.
- b) **ATR:** Principle (total internal reflection, evanescent wave, etc.), instrumentation (ATR crystal, IR beam), advantages and disadvantages, pharmaceutical applications.

**UNIT III**

**ELECTROMETRIC TECHNIQUES:** Principle, instrumentation and applications of Potentiometer, Amperometer, Conductometer and Polarography.

**UNIT IV**

- a) **Spectrofluorimetry:** Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analyzed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.
- b) **Flame emission spectroscopy and Atomic absorption spectroscopy:** Principle, Instrumentation, Interferences and applications.

**UNIT V**

**FT-Raman:** Principle (absorption, diffraction, scattering and emission of wave, molecular interaction), instrumentation (Dispersive Raman, FT-Raman), advantage and disadvantage, pharmaceutical applications including detection of counterfeit

**REFERENCE BOOKS:**

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. A Text book of Pharmaceutical Analysis by Kerrenth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett

9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein
11. HPTLC by P.D. Seth
12. Spectroscopy by Donald L Pavia, Gary M Lampman, George S Kriz, James A Vyvyan

SUCP

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**RESEARCH METHODOLOGY AND IPR**

**Course Objectives:**

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Understand research problem formulation.
- CO 2. Analyze research related information. Follow research ethics.
- CO 3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- CO 4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- CO 5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

**UNIT I**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**UNIT II**

Effective literature studies approaches, analysis, Plagiarism, Research ethics

**UNIT III**

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**UNIT IV**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**UNIT V:**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**TEXT BOOKS:**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Pharmaceutical Research Methodology and BioStatistics, B Subba Rao, Pharmamed Press
4. Intellectual Property Rights in Pharmaceutical Industry, B Subba Rao, Pharmamed Press

**REFERENCE BOOKS:**

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**ADVANCED ORGANIC CHEMISTRY – I LAB (LAB – I)**

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Synthesize a variety of organic and heterocyclic compounds using classical and modern synthetic methods.
- CO 2. Apply rearrangement, condensation, and Mannich reactions in drug synthesis.
- CO 3. Perform functional group transformations such as reduction, bromination, and oxidation for target molecules
- CO 4. Characterize synthesized compounds using standard analytical techniques.
- CO 5. Analyze reaction mechanisms and optimize conditions for efficient and selective drug synthesis.

**List of Experiments: (Minimum of 10 experiments shall be conducted)**

1. Synthesis and characterization of the following drugs:
  - a. Benzanilide by Beckmann rearrangement
  - b. 4-Benzylidene-2-methyloxazol-5-one (or) azalactone
  - c. N-(m-Nitrobenzyl) aniline from m-nitrobenzaldehyde
  - d. 2, 3-Diphenyl quinoxaline
  - e. 1H-Indole-3-carboxaldehyde
  - f. 3, 4-Dihydropyrimidin-2(1H)-one from benzaldehyde, ethyl acetoacetate and urea in presence of  $\text{CaCl}_2$  (catalyst).
  - g. Schiff base by microwave irradiation
  - h. Cinnamic acid by Perkin reaction
  - i.  $\beta$ -Dimethylaminopropiophenone hydrochloride (Mannich base)
  - j. 2-Phenyl indole
  - k. Dimedone (5,5-dimethyl cyclohexane-1,3-dione)
  - l. 3-Bromo cyclohexene from cyclohexene using NBS.
  - m. p-Amino benzyl alcohol from p-amino benzaldehyde using sodium borohydride.
  - n. Cyclohexane-2,5-dicarboxylic acid from benzoic acid (hydrogenation).
2. Any other relevant experiments based on theory.

**REFERENCE BOOKS:**

1. Roth H J, Kleemann A. Pharmaceutical Chemistry. Vol-I. Drug synthesis. New York: Ellis Horwood Limited; 1988.
2. Mann FG, Saunders BC. Practical organic chemistry. 4th ed. New Delhi: Orient Longman; 2005.
3. Furniss BS, Hanaford AJ, Smith PWG, Tatchell AR. Vogel's textbook of practical organic chemistry. 5th ed. Singapore: Longman Singapore Publishers P Ltd; 1989.
4. Vogel A. Elementary practical organic chemistry. Part 1: Small scale preparations. 2nd ed. New Delhi: CBS publishers and distributors; 2004.
5. Bansal RK. Laboratory manual of organic chemistry. 4<sup>th</sup> ed. New Delhi: New Age International (P) limited; 2005.
6. Kar A. Advanced Practical Medicinal Chemistry. New Delhi: New Age International (P) limited; 2006.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year I Sem (Pharmaceutical Chemistry)**  
**ADVANCED MEDICINAL CHEMISTRY – I LAB (LAB – II)**

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Synthesize selected drugs from analgesics, NSAIDs, antipyretics, CNS, and CVS classes.
- CO 2. Apply QSAR techniques using software tools like CoMFA, CODESSA.
- CO 3. Perform molecular docking studies of drugs using online tools.
- CO 4. Analyze drug-receptor interactions and predict biological activity through computational methods.
- CO 5. Interpret and correlate computational results to optimize drug design and efficacy.

**List of Experiments:**

1. Synthesis of any two drugs from the following classes of drugs (Minimum two from each class)
  - a. Analgesics, NSAIDs and antipyretics
  - b. CNS and CVS drugs
2. QSAR Studies by using softwares
  - a. CoMFA – 3D QSAR method,
  - b. CODESSA,
  - c. descriptor software (all are free online softwares) minimum of 3 experiments
3. Docking studies of drugs by using free online softwares like
  - a. AutoDock,
  - b. BLAST,
  - c. GPCRpred,
  - d. FASTA,
  - e. ATPINT,
  - f. Maestro,
  - g. ESLPRED2 (Minimum of 5 experiments)

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**ADVANCED ORGANIC CHEMISTRY-II (Professional Core – III)**

**Course Objective:** The content of Unit I and II are mainly aimed at utilization of different synthetic reagents used in the preparation of intermediates and final compounds and also aimed at the principles of green chemistry. Unit III and IV contents are mainly aimed at scale of processes for the preparation of new pharmaceutical agents and also to design different synthetic strategies. Unit V is mainly aimed to utilize the knowledge of chemical library for drug design

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain the use and applications of key synthetic reagents and principles of green chemistry in organic synthesis.
- CO 2. Differentiate types of catalysis and apply homogeneous, heterogeneous, transition-metal, organo-, biocatalysis, and phase-transfer methods in drug synthesis.
- CO 3. Apply carbon, nitrogen, and oxygen migration rearrangements in the synthesis of organic compounds and drugs.
- CO 4. Synthesize peptides using solid-phase and solution-phase methods, understanding coupling strategies and side reactions.
- CO 5. Design and execute combinatorial synthesis using solid-phase and parallel techniques for rapid drug discovery.

**UNIT I**

**Synthetic Reagents & Applications:** Lead Tetra Acetate (LTA), N- Bromosuccinimide (NBS), Osmium Tetroxide, Lithium Aluminum Hydride (LAH) and Sodium Borohydride, Dicyclohexylcarbodiimide (DCC) and 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ).

**A brief account on Green Chemistry:** Principles and applications

**UNIT II**

**Catalysis:**

- a. Types of catalysis, heterogeneous and homogeneous catalysis, advantages and disadvantages
- b. Heterogeneous catalysis – preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs.
- c. Homogeneous catalysis, hydrogenation, hydroformylation, hydrocyanation, Wilkinson catalysts, chiral ligands and chiral induction, Ziegler-Natta catalysts, some examples of homogeneous catalysis used in synthesis of drugs
- d. Transition-metal and Organo-catalysis in organic synthesis: Metal-catalyzed reactions
- e. Biocatalysis: Use of enzymes in organic synthesis, immobilized enzymes/cells in organic reaction.
- f. Phase transfer catalysis -theory and applications

**UNIT III**

Molecular Rearrangements & their applications:

1. **Carbon to Carbon Migration:** Wagner – Meerwin rearrangement, Claisen rearrangement and benzil – benzilic acid rearrangement.
2. **Carbon to Nitrogen Migration:** Hoffmann rearrangement, Curtius rearrangement and Lossen rearrangement, Beckman rearrangement.
3. **Carbon to Oxygen Migration:** Bayor – Villiger rearrangement, Rearrangement of hydro peroxides and Wittig rearrangement.

**UNIT IV****Chemistry of peptides**

- a. Coupling reactions in peptide synthesis
- b. Principles of solid phase peptide synthesis, t-BOC and FMOC protocols, various solid supports and linkers: Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and case studies, site-specific chemical modifications of peptides
- c. Segment and sequential strategies for solution phase peptide synthesis with any two case studies
- d. Side reactions in peptide synthesis: Deletion peptides, side reactions initiated by proton abstraction, protonation, overactivation and side reactions of individual amino acids.

**UNIT V**

**Combinatorial Chemistry:** Introduction, solid phase techniques, parallel synthesis, mixed combinatorial chemistry, deconvolution techniques, tagging, photolithography, limitations of combinatorial chemistry, planning and designing of combinatorial synthesis.

**TEXT BOOKS/REFERENCES:**

1. W. Carruthers, Some Modern Methods of Org. Synthesis, III rd Edition, Cambridge University Press, Cambridge (1988)
2. Gorgy Keri and Istarian Toth, Molecular Patho-mechanisms and New Trends in Drug Research – Taylor and Francis Group, London 2003
3. Organic Chemistry, V Algarsamy, Pharmamed Press.
4. R.K. Mackie, A Guidebook to Organic Thesis – Prentice Hall
5. T.W. Greene and PGM Warts, Protecting Groups – John Willey
6. Michael B. Smith, Organic Synthesis
7. Organic synthesis- Special techniques VK Ahluwalia and R Aggarwal, Narosa Publishers.
8. "Organic Chemistry" Vol I and II. I.L. Finar. ELBS, Sixth ed., 1995.
9. "Advanced Organic chemistry, Reaction, mechanisms and structure", JMarch, John Wiley and sons, New York.
10. Principles of organic synthesis, ROC Norman and JMCoxan, Nelson thorns
11. Carey, Organic chemistry, 5th edition (Viva Books Pvt. Ltd.)

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**ADVANCED MEDICINAL CHEMISTRY – II (Professional Core – IV)**

**Course Objective:** The course contents of Unit I and Unit II are mainly aimed at enzyme inhibitors for the treatment of different CNS and CVS diseases. Unit III contents are aimed to have advanced knowledge of the developments of antipsychotic agents. The remaining contents are aimed to design prodrugs, peptidomimetic agents and recombinant DNA products.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Know enzyme inhibitors — mechanisms and importance (prostaglandin synthetase, PDE, carbonic anhydrase,  $\beta$ -secretase).
- CO 2. Explain Structure and therapeutic roles of ACE, acetylcholinesterase, HMG-CoA, and protease inhibitors.
- CO 3. Understand Neurotransmitters in antipsychotics — dopamine, serotonin, glutamate; SAR and pharmacokinetics.
- CO 4. Study Endogenous peptides, peptidomimetics, and prodrug design (esters, amides).
- CO 5. Describe Recombinant DNA technology — production and immunogenicity of hormones, cytokines, and monoclonal antibodies.

### UNIT I

**Enzyme Inhibitors I:** A detailed study of the following types of enzyme inhibitors, related drugs and their pharmaceutical significance:

- a) Prostaglandin Synthetase (Cyclooxygenase & Lipoxygenase Inhibitors)
- b) Phosphodiesterase (PDE) Inhibitors
- c) Carbonic Anhydrase Inhibitors.
- d) B- Secretase.

### UNIT II

**Enzyme Inhibitors II:**

- a) Angiotensin Converting Enzyme (ACE) Inhibitors
- b) Acetyl Cholinesterase (Ach E) Inhibitors.
- c) HMG-CoA inhibitors
- d) Protease inhibitors

### UNIT - III

**Antipsychotic Agents:** Role of Dopamine, Serotonin, Glutamate and their receptors. SAR and Pharmacokinetics of Ticyclic Neuroleptics, Butyrophenones and Benzamides. A brief account of non – benzodiazepine agonist.

### UNIT - IV

**Peptidmimetic agents & Prodrugs**

- a) Physiological role of peptides, Endogenous peptide transmitters & function, cyclosporin and oxytocin
- b) Prodrugs belong to esters, Lactones, amides, hydrazides and azo compounds. Targeted prodrug, bioprecursor of prodrugs

### UNIT - V

**Biotechnologically produced drugs:** Biotechnology of Recombinant DNA, Process of Recombinant proteins, Immunogenicity of biotechnologically produced drugs.

**Recombinant drug products:** Hormones, cytokinins, interferons, Interleukins, enzymes, vaccines and monoclonal antibody drugs.

**TEXT BOOKS/REFERENCES:**

1. Berger's Medicinal Chemistry and Drug Design. 6<sup>th</sup> Edition
2. Korolkovas Essentials of Medicinal Chemistry
3. William O Foye Medicinal Chemistry
4. Lednicer, Organic Chemistry of Drug Synthesis
5. Ariens, Drug Design, Academic Press
6. Purcell Strategies of Drug Design
7. Corwin, Hansen Comprehensive Medicinal Chemistry
8. Richard B. Silvermann, Org. Chemistry of Drug Design and drug Action
9. Smith and Williams, Introduction to principles of Drug Design – Harwood Academy Press
10. Gyorgy Keri & Istvan Toth Molecular Pathomechanism and New Trends in Drug Research, Taylor & Francis Pub
11. Thomas Nogrady, Medicinal Chemistry. A biochemical Approach, Oxford Univ. Press.

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**PHARMACEUTICAL PROCESS CHEMISTRY (Professional Elective – III)**

**Course Objectives:** The goal of a process chemist is to develop synthetic routes that are safe, cost-effective, environmentally friendly, and efficient. The subject is designed to impart knowledge on the development and optimization of a synthetic route/s and the pilot plant procedure for the manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain scale-up strategies, process validation, and identify types and sources of impurities in APIs.
- CO 2. Apply principles of extraction, filtration, distillation, evaporation, and crystallization in pharmaceutical processes.
- CO 3. Describe nitration, halogenation, and oxidation reactions and their industrial applications in drug synthesis.
- CO 4. Apply reduction and fermentation techniques for the industrial production of antibiotics, vitamins, and statins.
- CO 5. Implement industrial safety measures, including PPE, hazard management, fire safety, and environmental compliance.

**UNIT I**

Process chemistry; Introduction, Synthetic strategy Stages of scale up process: Bench, pilot and large-scale process. In-process control and validation of large-scale process. Case studies of some scale up process of APIs. Impurities in API, types and their sources including genotoxic impurities

**UNIT II**

**Unit operations**

- a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction.
- b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration,
- c) Distillation: azeotropic and steam distillation
- d) Evaporation: Types of evaporators, factors affecting evaporation.
- e) Crystallization: Crystallization from aqueous, nonaqueous solutions factors affecting crystallization, nucleation. Principle and general methods of Preparation of polymorphs, hydrates, solvates and amorphous APIs.

**UNIT III**

**Unit Processes - I**

- a) Nitration: Nitrating agents, Aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration,
- b) Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process.
- c) Oxidation: Introduction, types of oxidative reactions, Liquid phase oxidation with oxidizing agents. Nonmetallic Oxidizing agents such as H<sub>2</sub>O<sub>2</sub>, sodium hypochlorite, Oxygen gas, ozonolysis.

**UNIT IV**

**Unit Processes - II**

- a) Reduction: Catalytic hydrogenation, Heterogeneous and homogeneous catalyst; Hydrogen transfer reactions, Metal hydrides. Case study on industrial reduction process.
- b) Fermentation: Aerobic and anaerobic fermentation.  
Production of
  - i. Antibiotics; Penicillin and Streptomycin,
  - ii. Vitamins: B<sub>2</sub> and B<sub>12</sub>
  - iii. Statins: Lovastatin, Simvastatin

- c) Reaction progress kinetic analysis
- i. Streamlining reaction steps, route selection,
  - ii. Characteristics of expedient routes, characteristics of cost-effective routes, reagent selection, families of reagents useful for scale-up.

## UNIT V

### Industrial Safety

- a) MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment (PPE)
- b) Fire hazards, types of fire & fire extinguishers
- c) Occupational Health & Safety Assessment Series 1800(OHSAS-1800) and ISO-14001(Environmental Management System), Effluents and its management

### REFERENCE BOOKS:

1. Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever-Changing Climate- An Overview; K. Gadamasetti, CRC Press.
2. Pharmaceutical Manufacturing Encyclopedia, 3rd edition, Volume 2.
3. Medicinal Chemistry by Burger, 6th edition, Volume 1-8.
4. W.L. McCabe, J.C Smith, Peter Harriott. Unit operations of chemical engineering, 7th edition, McGraw Hill
5. Polymorphism in Pharmaceutical Solids. Dekker Series Volume 95 Ed: HG Brittain (1999)
6. Regina M. Murphy: Introduction to Chemical Processes: Principles, Analysis, Synthesis
7. Peter J. Harrington: Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up
8. P. H. Groggins: Unit processes in organic synthesis (MGH)
9. F.A. Henglein: Chemical Technology (Pergamon)
10. M. Gopal: Dryden's Outlines of Chemical Technology, WEP East-West Press
11. Clausen, Mattson: Principle of Industrial Chemistry, Wiley Publishing Co.,
12. Lowenheim & M. K. Moran: Industrial Chemicals
13. S.D. Shukla & G. N. Pandey: A text book of Chemical Technology Vol. II, Vikas Publishing House
14. J. K. Stille: Industrial Organic Chemistry (PH)
15. Shreve: Chemical Process, McGraw-Hill.
16. B. K. Sharma: Industrial Chemistry, Goel Publishing House
17. ICH Guidelines
18. United States Food and Drug Administration official website [www.fda.gov](http://www.fda.gov)

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year – II Sem (Pharmaceutical Chemistry)**  
**QUALITY CONTROL AND QUALITY ASSURANCE (Professional Elective – III)**

**Course Objective:** This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

**Course Outcome: Upon completion of this course the student should be able to**

- CO 1. Explain the principles of quality control, quality assurance, GLP, and ICH Q-series guidelines in pharmaceutical research.
- CO 2. Apply cGMP standards and regulatory requirements for personnel, facilities, sanitation, and environmental control in pharmaceutical manufacturing.
- CO 3. Perform quality control of raw materials, in-process materials, and finished pharmaceutical products using relevant pharmacopoeial standards.
- CO 4. Maintain and manage pharmaceutical documentation, SOPs, batch records, and regulatory submission documents (DMF, CTD, eCTD).
- CO 5. Implement manufacturing controls, process monitoring, and intellectual property principles in pharmaceutical production.

#### **UNIT I**

Introduction: Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Qseries guidelines. Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non-clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.

#### **UNIT II**

cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice.

#### **UNIT III**

Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).

#### **UNIT IV**

Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non-regulated markets.

#### **UNIT V**

Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of

finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal. Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.

**REFERENCE BOOKS:**

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.
3. Quality control and Quality Assurance by Y anjaneylu, Pharmamed Press.
4. Quality Assurance of Pharmaceuticals - A compendium of Guide lines and Related materials Vol I & II, 2<sup>nd</sup> edition, WHO Publications, 1999.
5. How to Practice GMP's – P P Sharma, Vandana Publications, Agra, 1991.
6. The International Pharmacopoeia – vol I, II, III, IV & V - General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms, 3rd edition, WHO, Geneva, 2005.
7. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
8. ICH guidelines.
9. ISO 9000 and total quality management.
10. The drugs and cosmetics act 1940 – Deshpande, Nilesh Gandhi, 4<sup>th</sup> edition, Susmit Publishers, 2006.
11. QA Manual – D.H. Shah, 1st edition, Business Horizons, 2000.
12. Good Manufacturing Practices for Pharmaceuticals a plan for total quality control – Sidney H. Willig, Vol. 52, 3<sup>rd</sup> edition, Marcel Dekker Series.
13. Steinborn L. GMP/ISO Quality Audit Manual for Healthcare Manufacturers and Their Suppliers, Sixth Edition, (Volume 1 - With Checklists and Software Package). Taylor & Francis; 2003.
14. Sarker DK. Quality Systems and Controls for Pharmaceuticals. John Wiley & Sons 2008.
15. Packaging of Pharmaceuticals.
16. Schedule M and Schedule N.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**CLINICAL RESEARCH AND PHARMACOVIGILANCE (Professional Elective - III)**

**Course Objectives:** This subject will provide a value addition and current requirement for the students in clinical research and pharmacovigilance. It will teach the students on conceptualizing, designing, conducting, managing and reporting of clinical trials. This subject also focuses on global scenario of pharmacovigilance in different methods that can be used to generate safety data. It will teach the students in developing drug safety data in pre-clinical, clinical phases of drug development and post market surveillance.

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Explain ICH-GCP guidelines, ethical principles, and informed consent procedures in clinical trials.
- CO 2. Differentiate clinical trial designs and describe roles and responsibilities of trial personnel.
- CO 3. Prepare clinical trial documents and monitor, detect, and manage adverse drug reactions.
- CO 4. Understand pharmacovigilance principles, regulatory requirements, and establishment of safety monitoring systems.
- CO 5. Apply pharmacovigilance methods and use reporting tools for assessing and reporting drug safety data.

**UNIT I**

**Regulatory Perspectives of Clinical Trials:**

Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH- GCP) guidelines Ethical Committee: Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant-Schedule Y, ICMR, Informed Consent Process: Structure and content of an Informed Consent Process Ethical principles governing informed consent process

**UNIT II**

**Clinical Trials: Types and Design:**

Experimental Study- RCT and Non RCT, Observation Study: Cohort, Case Control, Cross sectional Clinical Trial Study Team Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management.

**UNIT III**

**Clinical Trial Documentation:**

Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring-Safety Monitoring in CT Adverse Drug Reactions: Definition and types. Detection and reporting methods. Severity and seriousness assessment. predictability and preventability assessment. Management of adverse drug reactions; Terminologies of ADR.

**UNIT IV**

**Basic aspects, terminologies and establishment of pharmacovigilance:**

History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring Program, WHO and Regulatory terminologies of ADR, evaluation of medication safety, establishing pharmacovigilance centres in Hospitals, Industry and National Programs related to pharmacovigilance. Roles and responsibilities in Pharmacovigilance.

**UNIT V****Methods, ADR reporting and tools used in pharmacovigilance:**

International classification of diseases, International Non-proprietary names for drugs, Passive and Active surveillance, Comparative observational studies, Targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, VigiFlow, Statistical methods for evaluating medication safety data.

**REFERENCE BOOKS:**

1. Central Drugs Standard Control Organization- Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice. E6; May 1996.230
3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
4. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
5. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
6. Handbook of clinical Research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone.
7. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
8. Textbook of Pharmacovigilance: Concept and Practice. G.P. Mohanta and P. K. Manna. 2016, Pharma Med Press.
9. A textbook of Clinical Pharmacy Practice: Essential Concepts and Skills. Second Edition, 2012, University Press
10. A Textbook of Clinical Research and Pharmacovigilance by KPR Chowdary, Pharmamed Press

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**SCREENING METHODS IN PHARMACOLOGY (Professional Elective - IV)**

**Course Objective:** The students are going to study about various techniques for screening of drugs for various pharmacological activities and guide lines for handling animals and human and animal ethics for screening of drugs.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Handle and breed laboratory animals following CPCSEA guidelines and Good Laboratory Practices.
- CO 2. Perform and interpret bioassays for vaccines, hormones, and antitoxins.
- CO 3. Conduct acute, sub-acute, and chronic toxicity studies according to OECD guidelines.
- CO 4. Evaluate cardiac and anti-diabetic activities of new substances through organized screening.
- CO 5. Assess psychopharmacological, anti-inflammatory, and analgesic activities of new compounds.

**UNIT I**

Care Handling and breeding techniques of laboratory animals, Regulations for laboratory animals, CPCSEA guidelines, alternatives to animal studies, Good laboratory Practices.

**UNIT II**

Bioassays: Basic principles of Biological standardization: Methods used in the bio-assay of Rabbis Vaccine, Oxytocin, Tetanus Antitoxin and Diphtheria Vaccine. Test for pyrogens.

**UNIT III**

Toxicity tests: OECD guidelines, determination of LD50, acute, sub-acute and chronic toxicity studies.

**UNIT IV**

Organization of screening for the Pharmacological activity of new substances with emphasis on the evaluation of cardiac and anti-diabetic activities.

**UNIT V**

Organization of screening for the Pharmacological activity of new substances with emphasis on the evaluation of psychopharmacological, anti-inflammatory and analgesic activities.

**TEXT BOOKS:**

1. Screening methods in Pharmacology, Vol.-1&2 by Robert.A. Turner and Peter Hebborn.
2. Drug discovery and evaluation by H.G. Vogel and W.H. Vogel, Springer-Verlag, Berlin Heidelberg.
3. Handbook of experimental pharmacology by S.K. Kulkarni, Vallabh Prakashan, Delhi.
4. Guidelines and Screening Methods of Pharmacology, Surendra H. Bodakhe, Pharmamed Press.

**REFERENCE BOOKS:**

1. ICH of technical requirements for registration of pharmaceuticals for human use, ICH harmonized tripartite guidelines - Guidelines for good clinical practice, E6, May 1996.
2. Good clinical practice - Guidelines for Clinical trials on pharmaceutical products in India, Central drug standard control organization, New Delhi, Minister of Health- 2001.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**ADVANCED INSTRUMENTAL ANALYSIS (Professional Elective – IV)**

**Course Objectives:** This subject deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, and hyphenated techniques.

**Course Outcome: Upon completion of the course a learner shall be able to**

- CO 1. Explain X-ray diffraction principles and apply crystallographic methods for structural analysis.
- CO 2. Describe biochromatography and supercritical fluid chromatography principles and their pharmaceutical applications.
- CO 3. Understand and apply capillary electrophoresis techniques for pharmaceutical analysis.
- CO 4. Interpret DSC, DTA, and TGA data for pharmaceutical characterization and stability studies.
- CO 5. Utilize SEM, ORD, and circular dichroism techniques for structural and stereochemical analysis of compounds.

#### UNIT I

**X-Ray diffraction methods:** Origin of X-rays, basic aspects of crystals, X-ray crystallography, miller indices, rotating crystal techniques, single crystal diffraction, powder diffraction, structural elucidation and applications.

#### UNIT II

- a. **Biochromatography:** Size exclusion chromatography, ion exchange chromatography, ion pair chromatography, affinity chromatography general principles, stationary phases and mobile phases.
- b. **Super critical fluid chromatography:** Principles, instrumentation, pharmaceutical applications.

#### UNIT III

**Capillary Electrophoresis:** Overview of CE in pharmaceutical analysis, basic configuration, CE characteristics, principles of CE, methods and modes of CE. General considerations and method development in CE,

#### UNIT IV

- a. **DSC:** Principle, thermal transitions, instrumentation (Heat flux and power- compensation designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, Sources of errors) and their influence, advantages and disadvantages, pharmaceutical applications.
- b. **DTA:** Principle, instrumentation, advantage and disadvantage, pharmaceutical application, derivative differential thermal analysis (DDTA).
- c. **TGA:** Principle, instrumentation, factors affecting results, advantages and disadvantages, pharmaceutical application.

#### UNIT V

- a. **Scanning electron microscope (SEM):** Principles, Instrumentation and applications.
- b. Optical Rotatory Dispersion (ORD), Circular Dichroism, Cotton effect, Octane rule and applications.

#### REFERENCE BOOKS:

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. A Text book of Pharmaceutical Analysis by Kerrenth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp

8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein
11. HPTLC by P.D. Seth

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**HERBAL DRUG TECHNOLOGY (Professional Elective – IV)**

**Course Objectives:** Helps the students in getting exposed to methods of extraction, preparation and purification of herbal extracts. To acquire knowledge on the preparation and standardization of herbal preparation. They will expose to various research institutions of natural products.

**Course Out comes: Upon completion of the course a learner shall be able to**

- CO 1. Identify and apply equipment for size reduction, filtration, evaporation, drying, and solvent recovery in herbal extraction.
- CO 2. Describe natural excipients, their sources, chemical nature, and pharmaceutical applications.
- CO 3. Prepare and evaluate herbal tablets, capsules, ointments, and other dosage forms with reference to herbal formulations.
- CO 4. Apply regulations and labeling standards for herbal products and dietary supplements under national and international laws.
- CO 5. Explain sources, properties, and uses of natural colorants and sweeteners in pharmaceutical and food products.

#### **UNIT I**

Equipment for preparing herbal extracts: Process and equipments- Name of the equipment and its uses with merits and demerits in each of the following unit operations in the extraction process.

1. Size reduction
2. Filtration
3. Evaporation/Distillation
4. Drying of extracts
5. Solvent recovery

#### **UNIT II**

Definition, classification of natural excipients: Sources, Chemical nature, Description parameters  
Pharmaceutical uses and storage conditions of following Natural excipients  
Binding agents, disintegrating agents, diluents, emulsifying agents:  
Acacia, Tragacanth, Alginates, CMC, Gelatin, Pectin, Lactose, Starches, Talc,  
Ointment bases, suppository bases and Hardening agents: Beeswax, Cocoa butter, Lanolin, Hard paraffin

#### **UNIT III**

Methods of preparation and Evaluation of Herbal Tablets, Capsules, Ointments and other dosage forms.  
Study of any three formulations under each category with respect to their formulas and claims for various herbs used in them

#### **UNIT IV**

- a. Regulations and Claims – Current Products: Label Claims, Nutrient Content Claims, health claims, Dietary Supplements Claims.
- b. Food Laws and Regulations, FDA, FPO, MPO, BIS, AGMARK.

#### **UNIT V**

**a) Natural colorants:** Biological Source, coloring principles, chemical nature and usage of the following Annatto, Cochineal, Caramel, Henna, Indigo, Madder, Saffron, Turmeric

**b) Natural sweeteners:**

- 1) Definition of nutritive and non-nutritive sweeteners, qualities of an ideal sweetener and sweetness potency.
- 2) Biological source, chemical nature, extraction details and usage of the following: Steviosides, Glycyrrhizin, Rebaudioside

**REFERENCE BOOKS:**

1. Textbook of Pharmacognosy by G. E. Trease, W. C. Evans, ELBS
2. Textbook of HPTLC by P.D. Seth.
3. Herbal Perfumes and cosmetics by Panda
4. Pharmacognosy by V.E Tyler, LR Brandy and JE Robbers (KM Varghese & co., Mumbai)
5. Natural Excipients by R. S Gaud, Surana.
6. Herbal Drug Technology By SL Deore
7. Herbal Drug industry by RD Chowdary
8. Herbal Drug Technology by SS Agarwal
9. Pharmacognosy and Phytochemistry by VD Rangari.
10. Indian Pharmacopoeia
11. Dietetics by Sri Lakshmi
12. Pharmaceutical Dosage forms - Tablets (Vol I, II and III) by Lieberman, Lachman and Schwartz.
13. Pharmaceutical Dosage forms - Capsules (Vol I, II and III) by Avis, Lieberman and Lachman.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**ADVANCED ORGANIC CHEMISTRY – II LAB (Lab – III)**

**Course Out comes: Upon completion of the course a learner shall be able to**

- CO 1. Estimate pharmacopoeial compounds, DNA/RNA, and vitamins using UV-Visible and fluorimetric techniques.
- CO 2. Perform simultaneous estimation of multi-component formulations and determine elemental ions using flame photometry.
- CO 3. Apply column chromatography, HPLC, and GC methods for separation and analysis of pharmaceutical compounds.
- CO 4. Carry out synthetic reactions, multi-step synthesis, purification, and characterization using TLC, melting point, and IR spectroscopy.
- CO 5. Analyze elements, functional groups, and perform degradation studies on natural and plant-derived compounds.

**List of Experiments:**

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on Column chromatography
4. Experiments based on HPLC
5. Experiments based on Gas Chromatography
6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry
8. To perform the following reactions of synthetic importance Purification of organic solvents, column chromatography
  - a. Claisen-schimidt reaction.
  - b. Benzyllic acid rearrangement.
  - c. Beckmann rearrangement.
  - d. Hoffmann rearrangement
  - e. Mannich reaction
9. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments)
10. Estimation of elements and functional groups in organic natural compounds Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data.
11. Some typical degradation reactions to be carried on selected plant constituents

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm I Year II Sem (Pharmaceutical Chemistry)**  
**ADVANCED MEDICINAL CHEMISTRY – II LAB (Lab – IV)**

**Course Out comes: Upon completion of the course a learner shall be able to**

- CO 1. Synthesize and characterize drugs like Phenacetin, Benzocaine, and Aspirin.
- CO 2. Determine the partition coefficient of medicinal compounds using the shake flask method.
- CO 3. Analyze the chemical properties of synthesized drugs like Paracetamol and Isoniazid.
- CO 4. Apply synthetic techniques to prepare drugs such as Tolbutamide and Sulphasalazine.
- CO 5. Evaluate the purity and identity of synthesized compounds like Phenothiazine and Uramil

**List of Experiments: (Minimum of 10 experiments shall be conducted)**

1. Synthesis and characterization of the following drugs:
  - a. Phenacetin
  - b. Antipyrin
  - c. Benzocaine
  - d. Uramil
  - e. Tolbutamide
  - f. Phenothiazine
  - g. Isoniazid
  - h. Sulphasalazine
  - i. aspirin from salicylic acid
  - j. paracetamol from p-aminophenol
2. Determination of partition coefficient of any medicinal compound by shake flask method.
3. Any other relevant experiments based on theory.

**REFERENCES:**

1. Lednicer D, Mitscher LA, The organic chemistry of drug synthesis, Volume-1-6. New York: A wiley-interscience publication; 2005.
2. Mann FG, Saunders BC. Practical organic chemistry. 4th ed. New Delhi: Orient Longman; 2005.
3. Furniss BS, Hanaford AJ, Smith PWG, Tatchell AR. Vogel's textbook of practical organic chemistry. 5th ed. Singapore: Longman Singapore Publishers P Ltd; 1989.
4. Vogel A. Elementary practical organic chemistry. Part 1: Small scale preparations. 2nd ed. New Delhi: CBS publishers and distributors; 2004.
5. Bansal RK. Laboratory manual of organic chemistry. 4<sup>th</sup> ed. New Delhi: New Age International (P) limited; 2005.
6. Kar A. Advanced Practical Medicinal Chemistry. New Delhi: New Age International (P) limited; 2006.
7. Indian Pharmacopoeia. Controller of Publication. Delhi, 1996.
8. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2008.
9. United States Pharmacopoeia. United States Pharmacopoeial Convention, Inc, USA, 2003.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm II Year I Sem (Pharmaceutical Chemistry)**  
**BIostatISTICS (Professional Elective - V)**

**Course Objective:** The student shall know the introduction, scope of biostatistics and Research work, calculation and present of the data.

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Understand the Biostatistics arrangement
- CO 2. Know the presentation and formation of tables and charts
- CO 3. Learn the correlation and regression
- CO 4. Gain the knowledge of analysis of data
- CO 5. Learn the Hypothesis testing

#### **UNIT I**

**Introduction and scope of biostatistics:** Use of statistics in Pharmacy. Population and Sample collection. Stages of research, types of data and methods of data collections. Data arrangement and presentation, formation of table and charts.

#### **UNIT II**

**Measures of central tendency:** computation of means, median and mode from grouped and ungrouped data.

**Measure of dispersion:** computation of variance, standard deviation, standard error and their coefficients.

#### **UNIT III**

Measures of Correlation and Regression

**Probability rules:** Binomial, Poisson and Normal distribution.

#### **UNIT IV**

Experimental designing, planning of an experiment, replication and randomization.

**Analysis of Variance (ANOVA):** 1-way, 2-Way

#### **UNIT V**

**Hypothesis testing:** Student 't' test, Chi square test,

**Non- Parametric Tests:** Sign Test, Sign Rank Test, Wilcoxon Sign Rank Test

#### **REFERENCE BOOKS:**

1. Statistics for business and economics 3rd edition by Vikas books publications
2. Biostatistics & Computer applications by GN Rao and NK Tiwari
3. Sokal, R.R. and Rohlf, F.J. 1987. An Introduction to Biostatistics. W.H. Freeman and Company.
4. Bailey, N.T.J. 1981. Statistical Methods in Biology. English University Press.
5. Mitchell, K. and Glover, T. 2001. Introduction to Biostatistics. McGraw Hill, Publishing Co.
6. A Textbook of Research Methodologies and Biostatistics for Pharmacy Students, KPR Chowdary, Pharmamed Press.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm II Year I Sem (Pharmaceutical Chemistry)**  
**PHARMACEUTICAL PRODUCTION AND PACKAGING TECHNOLOGY**  
**(Professional Elective – V)**

**Course Objectives:** The student shall learn about Industrial area design, Current good manufacturing practices. They also learn about packaging components, polymers and metals used in packaging. They also understand about the storage conditions of different formulations and their stability evaluations.

**Course Out comes: Upon completion of the course a learner shall be able to**

- CO 1: Explain the design and layout of pharmaceutical production areas, including utilities, material movement, and warehouse handling.
- CO 2: Describe current Good Manufacturing Practices (GMP) related to facility design, cleanroom control, documentation, and record keeping.
- CO 3: Discuss pharmaceutical packaging systems, components, and materials used for various dosage forms.
- CO 4: Explain stability testing of pharmaceutical products and packaging as per regulatory and ICH guidelines.
- CO 5: Describe packaging requirements and materials for solids, semisolids, parenterals, ophthalmic preparations, and aerosols.

#### **UNIT I**

**Production Area Design:** Selection of plant location, Design of plant for bulk drugs and formulations (Solids, Semisolids, Injectables, Nutraceuticals etc), General utilities such as purified water, portable water, water for injection, Air handling units-Relative humidity and Temperature control, Material and personnel movement. Warehouse handling-API, Excipients, packaging materials and solvents.

#### **UNIT II**

**Current Good Manufacturing Practices:** GMP design for buildings & facilities. GMP layout design. Clean room classifications. Segregation & cross contamination control. HVAC (heating, ventilation & air-conditioning) systems. Clean room environment control. Documentation and record keeping: Specifications and testing procedures, Specifications for finished products, Master Formulae, Packaging instructions. Batch processing records, Standard operating procedures.

#### **UNIT III**

**Pharmaceutical packaging and Design:** Introduction, Packaging system, Components of packaging, Symbols used on packages and labels. Package development and Design research. Packaging materials- Polymers and Plasters, Glass, Metal and Blister and strip packaging.

#### **UNIT IV**

**Stability of Packaging:** Introduction, Legislation, Regulation, Pharmaceutical Stability Testing in Climatic Cabinets, Pharmaceutical Stability Testing Conditions, Photo-Stability Testing, Review of Pharmaceutical Product Stability, Packaging and the ICH Guidelines.

#### **UNIT V**

**Packaging of Solids, Semisolids, Parenterals, Ophthalmic and Aerosols:** Introduction, Packaging of Solid and semisolids, Packaging of Sterile Pharmaceuticals, Packaging Components, Inspection of Filled Injectable Products, Storage and Labelling, Packaging of Ophthalmics, Selection of Packaging Materials, Packaging of Aerosols.

#### **REFERENCE BOOKS:**

1. Leon Lachman; Lieberman Herbert A.; Kanig, Joseph L. The theory and Practice of Industrial Pharmacy.
2. Gilbert Banker and Christopher Rhodes. Modern Pharmaceutics.
3. Aulton's Pharmaceutics: The design and Manufacture of Medicine
4. D. A. Dean, Roy Evans, Ian Hall. Pharmaceutical packaging technology. Tylor and Francis.

5. Edward J. Bauer, Pharmaceutical Packaging Handbook. Bausch and Lomb, Rochester, New York, USA.
6. Pharmaceutical Facilities: Design, Layouts and Validation, Potdar, Pharmamed Press
7. Wilmer A. Jenkins, Kenton R. Osborn. Packaging drugs and pharmaceuticals.
8. Remington: The Science and Practice of Pharmacy. 8. Michael E. Aulton, Kevin Tylor
9. Pharmaceutical Packaging Technology, UK jain, Pharmamed Press

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm II Year I Sem (Pharmaceutical Chemistry)**  
**SCALE UP AND TECHNOLOGY TRANSFER (Professional Elective - V)**

**Course Objective:** This course is designed to impart knowledge and skills necessary to train the students to be on scale up, technology transfer process and industrial safety issues.

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Understand pilot plant design, equipment selection, and scale-up processes for various dosage forms, including tablets, capsules, liquids, semisolids, parenterals, and NDDS products.
- CO 2. Learn the principles of validation, including procedures, protocols, documentation, analytical method validation, cleaning validation, and vendor qualification.
- CO 3. Gain knowledge of equipment qualification (IQ, OQ, PQ) for pharmaceutical machinery and aseptic room validation.
- CO 4 Apply process validation concepts for manufacturing steps such as mixing, granulation, drying, compression, coating, filling, sterilization, and environmental control.
- CO 5. Understand industrial safety, hazard identification, prevention systems, effluent testing, and environmental pollution control in pharmaceutical industries.

**UNIT I**

**Pilot plant design:** Basic requirements for design, facility, equipment selection, for tablets, capsules, liquid orals, parenteral and semisolid preparations.

**Scale up:** Importance, Technology transfer from R & D to pilot plant to plant scale, process scale up for tablets, capsules, liquid orals, semisolids, parenteral, NDDS products – stress on formula, equipments, product uniformity, stability, raw materials, physical layout, input, in-process and finished product specifications, problems encountered during transfer of technology

**UNIT II**

**Validation:** General concepts, types, procedures & protocols, documentation, VMF. Analytical method validation, cleaning validation and vendor qualification.

**UNIT III**

**Equipment Qualification:** Importance, IQ, OQ, PQ for equipments – autoclave, DHS, membrane filter, rapid mixer granulator, cone blender, FBD, tablet compression machine, liquid filling and sealing machine. Aseptic room validation.

**UNIT IV**

**Process validation:** Importance, validation of mixing, granulation, drying, compression, tablet coating, liquid filling and sealing, sterilization, water process systems, environmental control.

**UNIT V**

**Industrial safety:** Hazards – fire, mechanical, electrical, chemical and pharmaceutical, Monitoring & prevention systems, industrial effluent testing & treatment. Control of environmental pollution.

**REFERENCE BOOKS:**

1. Pharmaceutical process validation, JR Berry, Nash, Vol 57, Marcel Dekker, NY.
2. Pharmaceutical Production facilities, design and applications, by GC Cole, Taylor and Francis.
3. Pharmaceutical project management, T. Kennedy, Vol 86, Marcel Dekker, NY.
4. The theory & Practice of Industrial Pharmacy, L. Lachman, H.A. Lieberman, Varghese Publ Bombay.
5. Tablet machine instruments in pharmaceuticals, PR Watt, John Wiloy.
6. Pharmaceutical dosage forms, Tablets, Vol 1, 2, 3 by Lachman, Lieberman,

7. Dekker, NY.
8. Dispersed system Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
9. Subrahmanyam, CVS, Pharmaceutical production and Management, 2007, Vallabh Prakashan, Delhi.
10. Pharmaceutical Process Scale-up 2nd Ed. Levin Michael, CRC press

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)**

**Prerequisite:** None

**Course objectives:** Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Plan and structure sentences and paragraphs, write concisely, and avoid ambiguity, redundancy, and vague expressions.
- CO 2. Understand how to clearly present findings, paraphrase correctly, avoid plagiarism, and effectively write abstracts and introductions.
- CO 3. Organize and write all sections of a research paper, including literature review, methods, results, discussion, and conclusions.
- CO 4. Gain key skills for writing strong titles, abstracts, introductions, and literature reviews
- CO 5. Develop skills to write methods, results, discussions, and conclusions effectively, using useful phrases and strategies for successful first-time submissions.

**UNIT-I:**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

**UNIT-II:**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**UNIT-III:**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**UNIT-IV:**

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

**UNIT-V:**

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**TEXT BOOKS/ REFERENCES:**

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**DISASTER MANAGEMENT (Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:** Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

**Course Outcomes:** Upon completion of the course a learner shall be able to

- CO 1. Explain the concepts, types, and impact of natural and man-made disasters.
- CO 2. Describe the economic, environmental, and social repercussions of various disasters.
- CO 3. Discuss disaster preparedness, monitoring, and community participation methods.
- CO 4. Evaluate disaster risk assessment techniques and strategies for risk reduction.
- CO 5. Summarize mitigation strategies and programs implemented for disaster management in India.

**UNIT-I:**

**Introduction:**

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**Disaster Prone Areas in India:**

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

**UNIT-II:**

**Repercussions of Disasters and Hazards:**

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

**UNIT-III:**

**Disaster Preparedness and Management:**

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

**UNIT-IV:**

**Risk Assessment Disaster Risk:**

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

**UNIT-V:****Disaster Mitigation:**

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

**TEXT BOOKS/ REFERENCES:**

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:**

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Recognize and pronounce Sanskrit alphabets correctly.
- CO 2. Form simple sentences using basic tenses in Sanskrit.
- CO 3. Understand the roots and grammatical order in Sanskrit.
- CO 4. Identify technical information in Sanskrit literature.
- CO 5. Relate Sanskrit concepts to modern engineering and scientific fields.

**UNIT-I:**

Alphabets in Sanskrit,

**UNIT-II:**

Past/Present/Future Tense, Simple Sentences

**UNIT-III:**

Order, Introduction of roots,

**UNIT-IV:**

Technical information about Sanskrit Literature

**UNIT-V:**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

**TEXT/ REFERENCE BOOKS:**

1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**VALUE EDUCATION (Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:** Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Explain the role of values and ethics in self and social development.
- CO 2. Demonstrate the importance of cultivating moral and human values.
- CO 3. Develop positive thinking and integrity for personal growth.
- CO 4. Practice tolerance, cooperation, and love for nature.
- CO 5. Apply principles of self-management, honesty, and good health for character building.

**UNIT-I:**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

**UNIT-II:**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

**UNIT-III:**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

**UNIT-IV:**

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

**UNIT-V:**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

**TEXT BOOKS/ REFERENCE BOOKS:**

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**CONSTITUTION OF INDIA (Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:** Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Describe the history, philosophy, and salient features of the Indian Constitution.
- CO 2. Explain the fundamental rights, duties, and directive principles of state policy.
- CO 3. Discuss the structure and functions of various organs of governance.
- CO 4. Analyze the role of local administration and importance of grassroot democracy.
- CO 5. Summarize the role and functioning of the Election Commission and welfare bodies.

**UNIT-I:**

**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble, Salient Features.

**UNIT-II:**

**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

**UNIT-III:**

**Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

**UNIT-IV:**

**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**UNIT-V:**

**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**TEXT BOOKS/ REFERENCES:**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**PEDAGOGY STUDIES (Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:** Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Understand the theories of learning and research methodologies in pedagogy.
- CO 2. Describe pedagogical practices used in formal and informal learning environments.
- CO 3. Evaluate the effectiveness of teaching methods and teacher education programs.
- CO 4. Explain the importance of professional development and support systems for teachers.
- CO 5. Identify research gaps and future directions in pedagogy and education systems.

**UNIT-I:**

**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

**UNIT-II:**

**Thematic overview:** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

**UNIT-III:**

Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

**UNIT-IV:**

**Professional development:** alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

**UNIT-V:**

**Research gaps and future directions:** Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

**TEXT BOOKS/ REFERENCES:**

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeamong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272–282.
5. Alexander RJ (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.
6. Chavan M (2003) *Read India: A mass scale, rapid, 'learning to read' campaign*.
7. [www.pratham.org/images/resource%20working%20paper%202.pdf](http://www.pratham.org/images/resource%20working%20paper%202.pdf).

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**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**STRESS MANAGEMENT BY YOGA (Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:**

- To achieve overall health of body and mind
- To overcome stress

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Explain the eight components (Ashtanga) of yoga and their significance.
- CO 2. Describe the principles of Yam and Niyam in daily life.
- CO 3. Apply ethical and moral disciplines (Do's and Don'ts) for mental well-being.
- CO 4. Demonstrate various Asanas and Pranayama techniques.
- CO 5. Analyze the benefits of yoga poses and breathing practices on mind and body.

**UNIT-I:**

Definitions of Eight parts of yog. (Ashtanga)

**UNIT-II:**

Yam and Niyam.

**UNIT-III:**

Do's and Don'ts in life.

- i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**UNIT-IV:**

Asan and Pranayam

**UNIT-V:**

- i) Various yog poses and their benefits for mind & body
- ii) Regularization of breathing techniques and its effects-Types of pranayam

**TEXT BOOKS/ REFERENCES:**

1. 'Yogic Asanas for Group Training-Part-I': Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD**  
**M.Pharm (Pharmaceutical Chemistry)**  
**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**  
**(Audit Course - I & II)**

**Prerequisite:** None

**Course Objectives:**

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

**Course Outcomes: Upon completion of the course a learner shall be able to**

- CO 1. Interpret Neetishatakam verses for wisdom, virtue, and personality development.
- CO 2. Apply moral guidance from Neetishatakam to everyday conduct.
- CO 3. Understand the teachings of Bhagavad Gita for performing duties with discipline.
- CO 4. Relate basic philosophical knowledge from Gita to self-awareness and attitude.
- CO 5. Develop enlightened personality traits based on spiritual and ethical values.

**UNIT-I:**

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

**UNIT-II:**

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (don't's)
- Verses- 71,73,75,78 (do's)

**UNIT-III:**

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

**UNIT-IV:**

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

**UNIT-V:**

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

**TEXT BOOKS/ REFERENCES:**

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.