

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.PHARMACY (PHARMACEUTICS)
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	Modern Pharmaceutics-I	3	1	0	4
Professional Core-II	Applied Biopharmaceutics and Pharmacokinetics	3	1	0	4
Professional Elective-I	1. Advanced Physical Pharmaceutics 2. Drug Regulatory affairs 3. Total Quality Management	3	1	0	4
Professional Elective-II	1. Artificial Intelligence in Formulation and Process Development 2. Pharmaceutical Validation 3. Stability of Drugs and Dosage Forms	3	1	0	4
	Research methodology and IPR	2	0	0	2
Laboratory- I	Modern Pharmaceutics – I Lab	0	0	6	3
Laboratory- II	Applied Biopharmaceutics and Pharmacokinetics Lab	0	0	6	3
Audit - I	Audit Course- I	2	0	0	0
	Seminar & Assignment	0	0	4	2
	TOTAL	16	4	16	26

I YEAR II Semester

Course Code	Course Title	L	T	P	Credits
Professional Core-III	Modern Pharmaceutics - II	3	1	0	4
Professional Core-IV	Advanced Drug Delivery Systems	3	1	0	4
Professional Elective-III	1. Industrial Pharmacy 2. Herbal Cosmetics 3. Pharmaceutical Management	3	1	0	4
Professional Elective-IV	1. Nano based Drug Delivery Systems 2. Nutraceuticals 3. Clinical Research and Pharmacovigilance	3	1	0	4
Laboratory- III	Modern Pharmaceutics – II Lab	0	0	6	3
Laboratory- IV	Advanced Drug Delivery System 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
	TOTAL	16	4	16	26

II YEAR I Semester

Course Code	Course Title	L	T	P	Credits
Professional Elective-V	1. Biostatistics 2. Scale up and Technology Transfer 3. Production area, Design and Packaging Development	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
	TOTAL	6	2	32	24

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
	TOTAL	0	0	44	22

***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 (Pharmaceutics)

MODERN PHARMACEUTICS –I (Professional Core-I)

Course Objectives: Students will know the preformulation studies, methodology, different excipients used in solid dosage forms and their evaluation with references to production technologies. The students also know the optimization techniques and their applications in pharmaceutical industries.

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

CO 1. Gain knowledge of preformulation studies and ICH stability principles essential for ensuring the quality and stability of drug formulations.

CO 2. Understand the role and functional evaluation of excipients, co-processed materials, and learn modern formulation approaches of solid dosage forms.

CO 3. Learn various coating methods, powder formulation processes, and microencapsulation techniques used in solid dosage form development.

CO 4. Gain knowledge of formulation development, equipment, and modern advancements in the manufacture and evaluation of gelatin capsules.

CO 5. Apply statistical design and optimization methods to enhance the quality and performance of pharmaceutical formulations.

UNIT I

Preformulation studies: Goals of preformulation, preformulation parameters, Polymorphs and Amorphous forms, selection of drugs- solubility, partition coefficient, salt forms, humidity, solid state properties, Particle Size Analysis (Laser Diffraction and Dynamic Light Scattering) drug-excipient compatibility, flow properties, format and content of reports of preformulation, preformulation stability studies as per ICH.

UNIT II

Formulation development of solid dosage forms – I: Excipients: New materials, excipient science - diluents, disintegrants, superdisintegrants, etc, evaluation of functional properties of excipient, co-processed materials, methods of preparation and evaluation. **Dosage forms:** Formulation development and advances in tablets, capsules and suppositories.

UNIT III

Formulation development of solid dosage forms– II: Coating, coating machines, coating techniques in tablet technology for product development, inprocess control of tablets, formulation development and manufacture of powder dosage forms for internal use and evaluation of powders.

Microencapsulation- Types and methodology.

UNIT IV

Formulation development of soft and hard gelatin capsules: Introduction, production and methods of manufacture, filling equipment and filling operations, formulations, finishing, special techniques- advances in capsule manufacture, physical stability and packaging. Evaluation of hard and soft gelatin capsules.

UNIT V

Optimization techniques in pharmaceutical formulation and processing: Introduction, optimization parameters, statistical design, response surface method, contour diagrams, factorial design, partial factorial design, simplex methods, mixture designs, Plackett Burman method, Box Benken method, applications in pharmaceutical formulation.

TEXT BOOKS

1. Pharmaceutics - The Science of Dosage form design by ME Aulton.
2. Pharmaceutical Dosage forms - Tablets (Vol I, II and III) by Lieberman, Lachman and Schwartz.
3. Pharmaceutical Dosage forms - Capsules (Vol I, II and III) by Avis, Lieberman and Lachman.
4. Pharmaceutical Dosage forms – Disperse systems (Vol I, II and III) by Avis, Lieberman and Lachman.
5. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes.
6. Pharmaceutical statistics by Bolton

REFERENCE BOOKS:

1. The Theory and Practice of industrial Pharmacy by Leon Lachman, Herbert A. Lieberman.
2. Remington's Science and Practice of Pharmacy by A. Gennaro.
3. Ansel's Pharmaceutical Dosage form and Drug delivery system by Loyd V. Allen, Jr. Nicholas G. Popovich, Howard C. Ansel.
4. Generic Drug Product Development by Leon Shargel and Isadore Kanfer.
5. Dispensing for Pharmaceutical Students by SJ Carter.
6. Industrial Pharmacy - Selected Topics, CVS Subramanyam and J Thimmasetty, Vallabh Prakashan Delhi – 2013

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

APPLIED BIOPHARMACEUTICS AND PHARMACOKINETICS (Professional Core – II)

Course Objectives: The student shall know about bioavailability, bioequivalence and factor affecting bioavailability. They also know the pharmacokinetic parameter like drug disposition, absorption, non-linear and time dependent pharmacokinetics. They also know about the drug interactions & problems associated in pharmacokinetic parameters calculations.

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

- CO 1. Gain knowledge of factors affecting the bioavailability and stability of dosage forms, bioequivalence concepts and various study designs.
- CO 2. Acquire knowledge of drug absorption-pharmacokinetics based on one and two compartment models and application to various routes of administration, determination of absorption rate constants and analysis of kinetics from urine samples.
- CO 3. Learn about compartment models and their merits and limitations. Application of models to determine various pharmacokinetic parameters.
- CO 4. Gain knowledge of Michaelis-Menten kinetics and causes of non-induction, non-linear binding and non-linearity of pharmacological responses. Students will also learn about altered kinetics in various diseases.
- CO 5. Acquire knowledge of time dependent pharmacokinetics, kinetics and study of drug-drug interactions and its mechanism.

UNIT I

Dissolution and Bioavailability

- a. Biological and metabolic factors affecting dissolution and bioavailability.
- b. Formulation factors affecting bioavailability of drugs in dosage forms of tablets, capsules, parenterals, liquid orals and topical dosage forms.
- c. **Bioavailability:** Importance, dose dependency, AUC, rate and extent, assessment, blood and urine samples, single dose and multiple dose studies, *In vitro- In vivo* Correlation analysis and Levels of Correlations. Application of relevant softwares for insilico evaluation (Winnolin & DDD plus).
- d. **Bioequivalence:** Importance equivalency concepts, biowaivers, study designs, protocol, transformation of data, Statistical Criteria as per the Regulations.

UNIT II

Pharmacokinetics – Absorption: Study of drug absorption-pharmacokinetics based on one- and two-compartment open models with first-order elimination kinetics. Application to various routes of administration including rapid intravenous injection, intravenous infusion, and oral administration. Determination of absorption rate constants using Wagner-Nelson and Loo-Riegelman methods. Introduction to flip-flop kinetics and the method of residuals. Analysis of kinetics from urine samples.

UNIT III

Pharmacokinetics – Drug Disposition: Compartment models: One, two and non-compartmental approaches to pharmacokinetics. Recent trends, merits and limitations of these approaches. Application of these models to determine the various pharmacokinetic parameters pertaining to:

- a. Distribution: Apparent volume of distribution and its determination.
- b. Metabolism: Metabolic rate constant, Factors affecting Metabolism
- c. Elimination: Over all apparent elimination rate constant and half-life.

All the above under the following conditions:

- 1. Intravenous infusion

2. Multiple dose injections

- d. Non-invasive methods of estimating pharmacokinetics parameters with emphasis on salivary and urinary samples.
- e. Concept of clearance: organ, total clearance, hepatic clearance, lung clearance and renal clearance.

UNIT IV

Non-linear pharmacokinetics: Concepts of linear and non-linear pharmacokinetics, Michaelis-Menton kinetics characteristics. Basic kinetic parameters, possible causes of non-induction, non-linear binding, and non-linearity of pharmacological responses.

Clinical Pharmacokinetics: Altered kinetics in pregnancy, child birth, infants and geriatrics. kinetics in GI disease, malabsorption syndrome, liver, cardiac, renal and pulmonary disease states.

UNIT V

Time dependent pharmacokinetics: Introduction, classification, physiologically induced time dependency: Chrono pharmacokinetics - principles, drugs– (amino glycosides, NSAIDS, antihypertensive drug) chemically induced dependency.

Drug Interactions: Kinetics of drug interaction, study of drug-drug interaction mediated through absorption, distribution, metabolism and elimination, mechanisms of interaction and consequence.

- ❖ Numerical problems associated with all units, if any.

TEXT BOOKS

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi.
2. Learn Shargel and ABC yu, Applied Biopharmacokinetics and Pharmacokinetics
3. Biopharmaceutics and Pharmacokinetics by C.V.S. Subrahmanyam, Vallabh Prakashan.2010.
4. Basic biopharmaceutics, Sunil S. Jambhekar and Philip J Brean.
5. Text book of Biopharmaceutics and Clinical Pharmacokinetics by NiaziSarfaraz, Pharmamed Press

REFERENCE BOOKS

1. Bio-Pharmaceutics and Pharmacokinetics by V. Venkateshwarlu.
2. Pharmacokinetics, Biopharmaceutics and Clinical pharmacy by Robert E. Notari.
3. Biopharmaceutics and Clinical Pharmacokinetics - An Introduction by Robert E. Notari.
4. Drug drug interactions, scientific and regulatory perspectives by Albert P. G

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

ADVANCED PHYSICAL PHARMACEUTICS (Professional Elective – I)

Course Objectives: Students shall know about particle science, polymer science and its use in pharmaceutical dosage forms. They also know the compression and consolidation parameters for powders and granules. Students also know about the rheology, disperse systems, dissolution and solubility parameters for dosage forms.

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

- CO 1. Describe about particle science, polymer science and its use in Pharmaceutical dosage forms.
- CO 2. Understand the physics of tablets, polymer classification and its applications in the Preparation of Solid Dosage Forms
- CO 3. Know the Basic Concept about the stability calculations, shelf life calculations and accelerated stability studies.
- CO 4. Understand the rheology, absorption related to liquids and semi-solid dosage forms.
able to know about Characterization of API, excipients and Pharmaceutical Dosage forms.
- CO 5. Understand about the rheology, disperse systems, the factors affecting the dissolution and solubility parameters for the preparation of different dosage forms in related to invitro/invivo correlations.

UNIT I

Polymer science: Classification, properties and characterization of polymers, phase separation, polymers in solid state, preparation of polymer solution, application of polymers in pharmaceutical formulations. Mechanism of biodegradation-biodegradable polymers including controlled drug delivery systems, Gastro-retentive and Transdermal Systems.

UNIT II

Physics of tablet compression: Basic principles of interactions, compression and consolidation, compression and consolidation under high loads, effect of friction, distribution of forces in compaction, force volume relationships, Heckel plots, compaction profiles, Working and principles of single and multiple compression machine with their tooling.

UNIT III

Kinetics and drug stability: Stability calculations, rate equations, complex order kinetics, Factors influencing stability, strategy of stability testing, method of stabilization, method of accelerated stability testing in dosage forms, temperature and humidity control, physical stability testing of pharmaceutical products. Photodegradation, Method, solid state decomposition.

UNIT IV

Viscoelasticity: Theoretical consideration, instrumentation, rheological properties of disperse systems and semisolids. Oscillatory testing, Creep measurement.

Characterization of API and excipients: Differential Scanning Calorimetry: Principle, thermal transitions, advantages, disadvantages, instrumentation, applications and interpretations

X Ray Diffraction methods: Origin of x-rays, principle, advantages, disadvantages, instrumentation, applications and interpretations.

Thermogravimetric analysis: Principle, instrumentation, applications and interpretations.

UNIT V

Dissolution and solubility: Solubility and solubilization of nonelectrolytes, solubilization by the use of surfactants, cosolvents, complexation, drug derivatisation and solid-state manipulation, Mechanisms of

Drug release - dissolution, diffusion (Matrix and Reservoir) and swelling controlled (Peppas Model) and dissolution equipments.

TEXT BOOKS:

1. Physical Pharmacy, 4th Edition by Alfred Martin.
2. Theory and Practice of Tablets – Lachman, Vol. 4.
3. Pharmaceutical Dosage forms – Disperse systems Vol. I & II.
4. Cartenson "Drug Stability, Marcel Decker Solid state properties, Marcel Dekker.
5. Industrial Pharmacy - Selected Topics, CVS Subramanyam and J Thimmasetty, Vallabh Prakashan Delhi – 2013.

REFERENCE BOOKS:

1. Dispersive systems I, II, and III.
2. Robinson. Controlled Drug Delivery Systems.

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

DRUG REGULATORY AFFAIRS (Professional Elective-I)

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

- CO 1. Understand the structure and functions of Indian drug regulatory authorities, drug laws, and various licensing procedures related to drug and formulation development.
- CO 2. Describe the principles of Good Manufacturing Practices (GMP), ICH guidelines, and quality systems required for compliant pharmaceutical manufacturing.
- CO 3. Discuss global regulatory frameworks and their impact on the design, development, and approval of pharmaceutical products.
- CO 4. Apply Good Documentation Practices in maintaining manufacturing, quality control, and distribution records to meet regulatory standards.
- CO 5. Identify major global regulatory authorities and outline the procedures for preparation and submission of Drug Master Files (DMFs) as per international requirements.

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 (Pharmaceutics)

TOTAL QUALITY MANAGEMENT (Professional Elective - I)

Course Objectives: Total quality management constitutes very useful chapter like –good manufacturing practices, GLP, GCP, ICH etc. Which increases the knowledge of students in various quality control & regulatory aspects.

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

- CO 1. Understand the basics of TQM, GLP, and GMP and why they are important for quality in pharmaceuticals
- CO 2. Gain knowledge about major global drug regulatory and accrediting agencies and their role in ensuring safe and effective medicines.
- CO 3. Apply GMP principles in manufacturing, quality control, and documentation of different pharmaceutical dosage forms.
- CO 4. Understand the regulatory requirements for pre-clinical and clinical studies, including toxicity tests, pharmacokinetics, and clinical trials.
- CO 5. Learn about the global pharmaceutical industry, its status in India, and how WHO, NABL, and ICH guidelines guide drug manufacturing and quality assurance.

UNIT - I

Concepts and Philosophy of TQM, GLP, GMP (orange guide).

UNIT – II

Drug regulatory and accrediting agencies of the world (USFDA, TGA, ICH, WHO, ISO etc.)

UNIT - III

Good manufacturing practices: Organization and personnel, responsibilities, training, hygiene. Premises: Location, design, plant layout, construction, maintenance and sanitation, environmental control, utilities and services like gas, water, maintenance of sterile areas, control of contamination. Equipments: Selection, purchase specifications, maintenance, clean-in-place, sterilize-in-place, methods (TP and STP). Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls on raw materials and finished dosage forms. Manufacture of and controls on dosage forms: Manufacturing documents, master formula, batch formula records, standard operating procedures, quality audits of manufacturing processes and facilities. In process quality controls on various dosage forms; sterile and non–sterile, standard operating procedures for various operations like cleaning, filling, drying, compression, coating, disinfections, sterilization, membrane filtration etc., Packaging and labelling control, line clearance, reconciliation of labels, cartons and other packaging materials. Quality Control Laboratory: Responsibilities, good laboratory practices, routine controls instruments, reagents, sampling plans, standard test procedures, protocols, non-clinical testing, controls on animal house. Data generation and storage, quality control documents, retention samples, records and audits of quality control facilities. Finished products release, quality review, quality audits, batch release document.

UNIT - IV

Regulatory Considerations for Pre-clinical and Clinical Evaluation: Pre-clinical requirements currently in use. Regulatory requirements of single dose and repeat dose toxicity studies. Study of specific toxicities such as mutagenicity, carcinogenicity and teratogenicity. Animal pharmacokinetics and toxicokinetics. Regulatory requirements of clinical evaluation, pharmacokinetics in man genetic polymorphism. Design and interpretation of clinical trials. Quality assurance standards as per ISO.

UNIT - V

Globalization of drug industry, present status and scope of pharmaceutical industry in India. WHO and NABL certification, ICH guidelines for manufacturing and quality assurance of drug formulation.

TEXT AND REFERENCE BOOKS:

1. Guidelines for Developing National Drug Policies; WHO Publications, 1998.
2. Quality Assurance of Pharmaceuticals—A Compendium of Guidelines and Related Materials, Vol.–1; WHO Publications.
3. A Guide to Total Quality Management by Kaushik Maitra and Sedhan K. Ghosh.
4. GMP by Mehra.
5. How to Practice GMP by P.P. Sharma.
6. ISO 9000 and Total Quality Management by Sadhan K. Ghosh.
7. Good Manufacturing Practices for Pharmaceuticals-A Plan for Total Quality Control by Sidney H. Willing & James R Stoker. (Drugs & Pharm. Sciences) Vol. 78; Marcel Dekker Inc.
8. OPPI-Quality Assurance, USP.
9. Current good manufacturing practices for pharmaceuticals by Manohar A. Potdar
10. Quality assurance and quality management in pharmaceutical industry by Y. Anjaneyulu and marayya
11. Total Quality Management, An integrated Approach by D. R. Kiran, BS Publications
12. Total Quality Management, 3rd edition by Joel E. Ross. CRC press

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

ARTIFICIAL INTELLIGENCE IN FORMULATION AND PROCESS DEVELOPMENT

Course Objectives: Understanding the fundamentals of Artificial Intelligence, Machine Learning and Deep Learning in the context of pharmaceutical formulation. Apply AI in pharmaceutical manufacturing through process analytical technology (PAT), real-time control, and smart manufacturing. Gain knowledge of Artificial Neural Networks and Neuro-Fuzzy Systems for formulation optimization and decision support. Explore the integration of Machine Learning in 3D printing of personalized dosage forms and process optimization. Analyze real-world case studies highlighting AI applications in formulation development, personalized medicine and AI-based devices

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

- CO 1. Explain the scope and significance of AI, ML, and DL in pharmaceutical formulation and identify appropriate algorithms for data analysis.
- CO 2. Apply AI tools to monitor, predict, and optimize pharmaceutical manufacturing processes such as blending, granulation, and coating.
- CO 3. Build and interpret neural network models and neuro-fuzzy systems for formulation prediction, optimization, and control.
- CO 4. Implement machine learning techniques in the design and 3D printing of personalized drug delivery systems.
- CO 5. Evaluate real-time industry case studies to understand the practical impact of AI in formulation settings.

UNIT-I

Fundamentals of AI and ML in Pharmaceutics

Definition, scope and relevance of AI, ML, and Deep Learning
Types of data: Structured, unstructured, and big data preprocessing
Learning paradigms: Supervised, unsupervised, reinforcement learning
Tools & Platforms: Python, R, KNIME MATLAB, TensorFlow
Overview of models: SVM, Decision Trees, Random Forest, Neural Networks

UNIT-II

AI in Preformulation and Formulation Development:

Application of AI in preformulation studies: Solubility, compatibility, excipient screening.
Design of Experiments (DoE) and AI-assisted QbD for optimizing formulations.
AI in Process Analytical Technology (PAT)
Process Prediction Models – AI models to simulate and optimize blending, granulation, compression and coating
Machine Learning in 3D-Printing of Dosage Forms.
Case studies.

UNIT-III

Artificial Neural Networks and Neuro-Fuzzy Models in the Development of Pharmaceutical Products

Basics of neural networks: nodes, layers, weights, and activation functions, Supervised vs unsupervised learning, Types of ANN: Feedforward, Backpropagation, Deep neural networks, Concept of fuzzy logic,

Adaptive Neuro-Fuzzy Inference Systems (ANFIS), Integration of neural networks with fuzzy logic, Applications in Formulation Development, Benefits, Challenges and Case studies.

UNIT-IV**Pharmacokinetics, Biopharmaceutics & Stability Modeling**

AI in pharmacokinetic and PBPK modeling: absorption, distribution, metabolism, and excretion (ADME), Tools: SimCyp, GastroPlus for modeling in vivo behavior of drug delivery systems, Neural networks for predicting shelf life and degradation kinetics, AI in enhancement of nanotechnology-based and targeted delivery systems, AI in IVIVC modeling and biopharmaceutic classification.

UNIT-V**Case Studies and Emerging Trends**

AI in personalized medicine and dose individualization

AI in bioavailability prediction and IVIVC modeling

AI-driven 3D printing in drug formulation

AI in robotics in Nano-based drug delivery systems

Recent case studies: AI in vaccine development, COVID-19 models

References:

1. Machine Learning for Drug Formulation and Process Development – Vijay Kumar Thakur (CRC Press)
2. Artificial Neural Networks: Applications in Chemical and Biological Engineering- S. Chakraverty, Smita Tapaswi, CRC Press, 2022
3. Artificial Intelligence in Drug Delivery – Abhay Shukla & Reinhold Kesharwani
4. A Handbook of Artificial Intelligence in Drug Delivery (2023), Philip, Shahiwala, Rashid, Faiyazuddin et al.
5. AI and ML in Pharmaceutiucal sciences-Harish Dureja

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

PHARMACEUTICAL VALIDATION (Professional Elective - II)

Course Objective: The main purpose of the subject is to understand about validation and how it can be applied to industry and thus to improve the quality of the products. The subject covers the complete information about validation, types, methodology and application.

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

- CO 1. Understand the concepts of qualification and validation, including the preparation of a Validation Master Plan and equipment qualification processes.
- CO 2. Learn how to qualify analytical instruments and glassware to ensure accuracy and reliability in pharmaceutical testing.
- CO 3. Perform qualification of laboratory equipment and utility systems like water, HVAC, and compressed gases used in pharmaceutical production.
- CO 4. Understand cleaning validation procedures, including method development, validation, and cleaning of equipment and facilities.
- CO 5. Learn the principles of analytical method validation and how to validate methods as per ICH and USP guidelines

UNIT I

Introduction: Definition of Qualification and Validation, Advantage of Validation, Streamlining of Qualification & Validation process and Validation Master Plan.

Qualification: User Requirement Specification, Design Qualification, Factory Acceptance Test (FAT)/ Site Acceptance Test (SAT), Installation Qualification, Operational Qualification, Performance Qualification, Re- Qualification (Maintaining status -Calibration Preventive Maintenance, Change management), Qualification of Manufacturing Equipment, Qualification of Analytical Instruments and Laboratory equipments.

UNIT II

Qualification of analytical instruments: Electronic balance, pH meter, UV-Visible spectrophotometer, FTIR, GC, HPLC, HPTLC

Qualification of Glassware: Volumetric flask, pipette, Measuring cylinder, beakers and burette.

UNIT III

Qualification of laboratory equipments: Hardness tester, Friability test apparatus, tap density tester, Disintegration tester, Dissolution test apparatus.

Validation of Utility systems: Pharmaceutical water system & pure steam, HVAC system, Compressed air and nitrogen.

UNIT IV

Cleaning Validation: Cleaning Validation - Cleaning Method development, Validation and validation of analytical method used in cleaning. Cleaning of Equipment. Cleaning of Facilities. Cleaning in place (CIP).

UNIT V

Analytical method validation: General principles, Validation of analytical method as per ICH guidelines and USP.

REFERENCE BOOKS:

1. T. Loftus & R. A. Nash, "Pharmaceutical Process Validation", Drugs and Pharm Sci. Series, Vol. 129, 3rd Ed., Marcel Dekker Inc., N.Y.
2. The Theory & Practice of Industrial Pharmacy, 3rd edition, Leon Lachman, Herbert A. Lieberman, Joseph. L. Karig, Varghese Publishing House, Bombay.
3. Validation Master plan by Terveeks or Deeks, Davis Harwood International publishing.
4. Validation of Aseptic Pharmaceutical Processes, 2nd Edition, by Carleton & Agalloco, (Marcel Dekker).
5. Michael Levin, Pharmaceutical Process Scale-Up, Drugs and Pharm. Sci. Series, Vol. 157, 2nd Ed., Marcel Dekker Inc., N.Y.
6. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider
7. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press
8. Pharmaceutical Facilities: Design, Layouts and Validation, 2nd Ed, Potdar, Pharmamed Press.
9. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2nd Ed.
10. Analytical Method validation and Instrument Performance Verification by Churg Chan, Heiman Lam

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

STABILITY OF DRUGS AND DOSAGE FORMS (Professional Elective - II)

Course Objectives: These topics are designed impart a specialized knowledge to preserve the properties of drugs and dosage forms during manufacture storage and shelf life. The understanding of properties and evaluation of stability during storage, by solution and solid state against several factors of degradation.

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

- CO 1. Understand the mechanisms of drug decomposition, including hydrolysis, oxidation, photolysis, and thermal degradation, and learn methods to stabilize pharmaceuticals.
- CO 2. Learn about solid-state chemical decomposition, including drug-excipient and drug-drug interactions, and methods to improve stability.
- CO 3. Perform physical stability testing of various dosage forms, including solids, dispersions, and novel drug carriers like liposomes and nanoparticles.
- CO 4. Understand stability testing of cosmetic products, including the application of cGMP and ICH guidelines, and container-closure compatibility studies.
- CO 5. Learn analytical methods to evaluate the quality and safety of finished cosmetic products, including toxicity testing and regulatory considerations.

UNIT-I

Drug decomposition mechanisms:

1. Hydrolysis and acyltransfers: Nature of reaction, structure and utility, stabilization of pharmaceutical examples.
2. Oxidation: Nature of oxidation, kinetics of oxidation, oxidation pathways of pharmaceutical, Interest Inhibition of oxidation
3. Photolysis: Energetics of photolysis, kinetics photolysis, photolytic reactions of pharmaceutical interest, prevention of photolytic reactions.
4. Thermal decomposition

UNIT-II

Solid state chemical decomposition: Kinetic of solids state decomposition, pharmaceutical examples of solid-state decomposition, Pure drugs, drug excipient and drug-drug interaction in solid state, methods of stabilization.

UNIT-III

Physical stability testing of dosage forms:

Solids – tablets, capsules, powder and granules

Disperse systems

Microbial decomposition

Overview, physical stability of novel drug carriers, liposomes, niosomes, nano-particles.

UNIT-IV

Physical stability testing of cosmetics dosage forms:

Dental products, Baby care products and Cosmetics

Stability studies: Concept of stability studies.

cGMP& ICH guidelines for Accelerated stability Testing.

Interaction of containers & closure Compatibility Testing.

UNIT-V

Methods of analysis to determine the quality of cosmetics in the finished forms such as Hair care products, Skin care products, Baby care products, Dental products, Personal hygiene products, Colour cosmetics, Ethnic products, Colour makeup preparation, Lipsticks, Hair setting lotions and Eye shadows. Toxicity testing in cosmetics and Safety and Legislation of Cosmetic products.

REFERENCE BOOKS:

1. Comprehensive Pharmacy Review 5th Edition by Leon Shargel, Alan H. Mutnick, Paul F. Souney, Larry N. Sawson – 2004.
2. A. H. Beckett and J. B. Stenlake Practical Pharmaceutical Chemistry, Part I and Part II, 4th Edition. 3. G. H. Jeffery, J. Basset, J. Mendham, R. C. Denny (Rev. by) Vogels Text Book of Quantitative Chemical Analysis, 5th Edition 1989, ELBS.
3. The Controller of Publications; New Delhi, Govt. of India, Indian Pharmacopoeia, Vol. I and Vol. II - 2010.
4. J. B. Wilkinson and R. J. Moore, Herry's Cosmeticology; Longman Scientific and Technical Publishers, Singapore.
5. P.D. Sethi; Quantitative Analysis of Drugs in Pharmaceutical Formulations, 3rd Edition - 1997,
6. Classification of cosmetics raw materials and adjuncts IS 3958 of Indian Standards Institution (BIS).
7. Cosmetic and toilet goods – methods of sampling IS 3958 of Indian Standards Institution (BIS).
8. Methods of sampling and test for various cosmetics as laid down by Bureau of Indian Standards.
9. Drug stability: Principles and practices by Jens T. Carstensen
10. Stability Testing of Drug Products by W. Grimm.
11. Stability of Drugs and Dosage Forms by Yoshioka and Stella.,BSP Books

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

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 (Pharmaceutics)

MODERN PHARMACEUTICS – I LAB (Laboratory - I)

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

- CO 1. Carry out Pre-formulation studies on solid dosage forms
- CO 2. Study the effect of particle size and various binders on in vitro release of drug.
- CO 3. Determine the rate constants of acid and alkaline hydrolysis
- CO 4. Formulate and evaluate beta cyclodextrin complexes of new drugs
- CO 5. Prepare paracetamol tablets and compare the in vitro release with marketed formulation

List of Experiments:

1. To carry out the preformulation studies of solid dosage forms.
2. To study the effect of compressional force on tablet disintegration time
3. To study the micromeritic properties of powders and granules
4. To study the effect of particle size on dissolution of capsules.
5. To study the effect of binders on dissolution of tablets
6. To study enteric coated tablets dissolution in relevant pH.
7. Accelerated stability testing of different tablets
8. Determination of first order, second order rate constants by acid and alkaline hydrolysis
9. Preparation and evaluation of beta cyclodextrin complexes of new drugs
10. Preparation of paracetamol tablets and comparison with marketed products
11. Design of experiments (DOE) in the optimization of an immediate release tablets.
12. Calculation of shelf life using accelerated stability data,

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutics)

APPLIED BIOPHARMACEUTICS AND PHARMACOKINETICS LAB (Laboratory- II)

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

- CO 1. Compare dissolution studies of different types of dosage forms.
- CO 2. Perform drug-protein binding analysis and calculation of bioavailability.
- CO 3. Calculate various pharmacokinetic parameters such as K_a , K_E , $t_{1/2}$, C_{max} , AUC etc.
- CO 4. Calculate bioavailability and bioequivalence studies.
- CO 5. Perform permeation studies and drug release from semisolids.

List of Experiments:

1. Analysis of dissolution by various data-kinetic modelling.
2. Calibration curve of different API's by UV/HPLC/HPTLC
3. Dissolution of immediate release, sustained release and delayed release.
4. Evaluation of drug-protein binding analysis
5. Assignment of numerical problems, one compartment and two compartment IV data and evaluation of pharmacokinetic parameters.
6. Calculation of K_a (absorption rate constant), method of residuals, Wagner nelson method and Loo- Riegel method.
7. Calculation of pharmacokinetics parameters of one compartment data and two compartment oral data.
8. Construction of IVIVC from the data
9. Calculation of Urinary Pharmacokinetics
10. Calculation of Bioavailability and Bioequivalence Studies
11. Permeation studies of Franz diffusion cell
12. Drug Release from semisolids by Agargel method or Franz diffusion cell.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

MODERN PHARMACEUTICS - II (Professional Core - III)

Course Objective: The students shall understand about the pilot plant and their scale up techniques for manufacturing of tablets capsules, suspensions, emulsions and semisolids. The students also learn the filling of capsules, compression machines, sterilizers for formulation of parenterals and also understand the properties of propellants, DPI, MDI and their quality control. The students also understand about the cosmetics and nutraceuticals.

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

- CO 1. Acquire knowledge of pilot plant scale up techniques used for pharmaceutical dosage forms such as tablets, capsules, suspensions, emulsions and semi solids.
- CO 2. Understand, production techniques, filling machines and sterilization methods for parenteral dosage forms.
- CO 3. Gain knowledge of different types of inhalers, types of containers, formulation, manufacture and quality control of pharmaceutical aerosols.
- CO 4. Learn about formulation, preparation and quality control testing of various cosmetics. Acquire knowledge of nutraceuticals, manufacture and analysis of glucosamine and carnitine and also the role of nutraceuticals in cancer prevention and cardiovascular disorders.
- CO 5. Gain knowledge of microbiological testing of air and water, characterization and evaluation of aseptic operations. Study of AHUs, humidity and temperature control.

UNIT I

Pilot plant scale-up techniques used in pharmaceutical manufacturing

a. Pilot plant: Technology transfer from R&D to pilot plant to pilot scale considerations of steps involved with manufacture, layout design, facility, equipment selection of tablets, capsules, suspensions, emulsions & semisolids.

b. Scale up: Importance, Scale up process-size reduction, mixing, blending, granulation, compression, coating involved in tablets, capsules & liquid-liquid mixing.

UNIT II

Formulation development of parenteral dosage forms: Advances in materials and production techniques, filling machines, sterilization methods (Moist heat, dry heat, filtration, radiation, gaseous sterilization), product layout.

UNIT III

Pharmaceutical Aerosols: Advances in propellants, metered dose inhaler designs, dry powder inhalers, selection of containers and formulation aspects in aerosols formulation, manufacture and quality control.

UNIT IV

a. Cosmetics: Formulation approaches, preparation & method of manufacturing labelling & Q.C. of anti-ageing products, sun screen lotion and fairness creams.

b. Nutraceuticals:

- 1. Introduction, source, manufacture and analysis of glucosamine & cartinine.
- 2. Monographs: General and specific properties of glucosamine & cartinine.
- 3. A brief overview of role of nutraceuticals in cancer prevention & cardio vascular disorders.

UNIT V**Aseptic processing operation**

- a. Introduction, contamination control, microbial environmental monitoring, microbiological testing of water, microbiological air testing, characterization of aseptic process, media and incubation condition, theoretical evaluation of aseptic operations.
- b. Air handling systems: Study of AHUs, humidity & temperature control.

TEXT BOOKS:

1. Pharmaceutics - The Science of Dosage form design by ME Aulton.
2. The Theory and Practice of industrial Pharmacy by Leon Lachman, Herbert A. Lieberman.
3. Remington's Science and Practice of Pharmacy by A. Gennaro.
4. Ansel's Pharmaceutical Dosage form and Drug delivery system by Loyd V. Allen, Jr.
5. Nicholas G. Popovich, Howard C. Ansel.
6. Pharmaceutical Dosage forms - Parenterals (Vol I, II and III) by Avis, Lieberman and Lachman.
7. Scale up techniques – Pharmaceutical process by Michael Levin, Marcel Dekker

REFERENCE BOOKS:

1. Bentley's Text Book of Pharmaceutics by EA Rawlins.
2. Generic Drug Product Development by Leon Shargel.
3. Dispensing for Pharmaceutical Students by SJ Carter.
4. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes.
5. Nutraceuticals, 2nd edition by Brian lock wood.
6. Industrial Pharmacy - Selected Topics, CVS Subramanyam and J Thimmasetty, Vallabha Prakashan Delhi - 2013

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

ADVANCED DRUG DELIVERY SYSTEMS (Professional Core - IV)

Course Objectives: The students shall apply the pharmacokinetic and pharmacodynamic principles in the design of CDDS. They also apply the design, evaluation and applications related to oral, parenteral, transdermal, implants, bioadhesives and targeted drug delivery systems.

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

- CO 1. Explain the principles, pharmacokinetic and pharmacodynamic basis, and design of controlled drug delivery systems for oral and parenteral routes.
- CO 2. Describe the design, fabrication, and evaluation of implantable, transdermal, ocular, intrauterine, and vaccine delivery systems.
- CO 3. Discuss biochemical and molecular approaches for advanced drug delivery using bio-adhesive, nasal, colonic, and sublingual systems.
- CO 4. Illustrate the formulation, evaluation, and applications of novel carrier-based systems such as liposomes, niosomes, microspheres, nanoparticles, and resealed erythrocytes.
- CO 5. Summarize targeted drug delivery strategies to specific organs like lungs, brain, and tumors, highlighting associated challenges and solutions.

UNIT I

Fundamentals of controlled drug delivery systems, pharmacokinetic and pharmacodynamic basis of controlled drug delivery. Design, fabrication, evaluation and applications of the following controlled releasing systems

- a. Controlled release oral drug delivery systems
- b. Parenteral controlled release drug delivery systems

UNIT II

Design, fabrication, evaluation and applications of the following

- a. Implantable Therapeutic systems
- b. Transdermal delivery systems
- c. Ocular and Intrauterine delivery systems
- d. Vaccine delivery: Delivery systems used to promote uptake, absorption enhancers, oral immunization, controlled release microparticles for vaccine development

UNIT III

Biochemical and molecular biology approaches for drug delivery using following technologies

- a. Bio-adhesive drug delivery systems
- b. Nasal drug delivery systems
- c. Drug delivery to Colon
- d. Sublingual drug delivery systems

UNIT IV

Design, fabrication, evaluation and applications of the following

- a. Liposomes
- b. Niosomes
- c. Microspheres
- d. Nanoparticles
- e. Resealed erythrocytes

UNIT - V

Drug targeting to particular organs

- a. Delivery to lungs

- b. Delivery to the brain and problems involved
- c. Drug targeting in neoplasms

TEXT BOOKS:

1. Novel Drug Delivery System by Yie W. Chien.
2. Controlled Drug Delivery by Joseph R. Robinson and Vincent H. L. Lee.
3. Controlled and Novel Drug Delivery Systems by N. K. Jain.
4. Targeted and Controlled Drug Delivery (Novel carrier systems) by S. P. Vyas and Khar.
5. Advances in Drug Delivery, 4 Vol. set, Rao Madhusudan Y, Pharmamed Press
6. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes.
7. Oral Drug Delivery Technology, 2nded, by Aukunuru Jithan

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

INDUSTRIAL PHARMACY (Professional Elective - III)

Course Objectives: The students shall learn the theory of unit operations, machinery, materials of constructions, qualification of equipments and its utility. The students shall also understand about the objectives and principles of GMP, TQM and effluent analysis and specifications. They also understand the regulatory basis for the validation of analytical methods related to solids, sterile and liquid dosage forms

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

- CO 1. Explain the machinery involved in milling, mixing, filtration and drying.
- CO 2. Gain knowledge of materials used in the construction of machinery and packaging materials.
- CO 3. Learn salient features of GMP, TQM applicable in industry
- CO 4 Understand the effluent treatments and prevent the pollution.
- CO 5. Evaluate the validation of analytical methods and processes

UNIT I

Pharmaceutical unit operations: A detailed study involving machinery and theory of Pharmaceutical unit operations like milling, mixing, granulation, blending and compression.

UNIT II

- a. Materials of construction of pharmaceutical equipment and packaging materials: Study of the principles, production techniques in the large-scale production of tablets, capsules, suspensions, liquid pharmaceuticals, ophthalmic products and sterile products.
- b. Qualification of equipment (IQ, OQ, PQ)

UNIT III

Production management: Production organization, objectives and policies of good manufacturing practices, layout of buildings, services, equipments and their maintenance, material management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Total Quality Management (TQM)

UNIT IV

Effluent Testing and Treatment: Effluent analysis, specifications and preventive measures water of pollution, solid pollution, air pollution and sound pollution.

UNIT V

Validation: Regulatory basis, validation process for solid dosage forms, sterile products, and liquid dosage forms.

TEXT BOOKS:

1. The Theory and Practice of industrial Pharmacy by Leon Lachman, Herbert A. Lieberman.
2. Good Manufacturing Practice for Pharmaceuticals by Sidney H. Willig.
3. Pharmaceutical Process validation by Robert A. Nash, Alfred H. Wachter.
4. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes.
5. Pharmaceutical production management, C.V.S. Subrahmanyam, Vallabh Prakash.
6. Industrial Pharmacy: A Comprehensive Approach, D K Tripathi, Pharmamed Press.

REFERENCE BOOKS:

1. Unit operations of Chemical Engineering by Warren L. McCabe, Julian C. Smith, Peter Harriott.
2. Remington's Science and Practice of Pharmacy by A. Gennaro.
3. Bentley's Text book of Pharmaceutics by EA Rawlins.
4. CGMP, H.P.P. Sharma

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

HERBAL COSMETICS (Professional Elective - III)

Course Objective: The topics helps the students to get exposed to processes involved in the manufacturing of herbal cosmetics including the skin and hair care herbal products preparation and their evaluation.

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

- CO 1. Understand the basics of herbal and natural cosmetics, including their classification, economic importance, and regulatory requirements for manufacturing and marketing.
- CO 2. Learn about commonly used herbal cosmetic raw materials, manufacturing processes, and general principles of quality control.
- CO 3. Prepare and evaluate skin care products such as creams, lotions, lipsticks, and face packs, understanding their composition and herbal claims.
- CO 4. Understand hair care products, including their preparation, evaluation, and the role of herbs in formulations like shampoos, oils, creams, and hair dyes.
- CO 5. Gain knowledge of important herbs used in cosmetics, their sources, active principles, and specific cosmetic properties.

UNIT - I

Introduction: Herbal/ natural cosmetics, Classification & Economic aspects.

Regulatory Provisions relation to manufacture of cosmetics: -

License, GMP, offences & Penalties, Import & Export of Herbal/natural cosmetics, Industries involved in the production of Herbal/natural cosmetics.

UNIT - II

- a) Commonly used herbal cosmetics raw materials –water, preservatives, surfactants, oils /waxes, colors, and some functional herbs
- b) Processes used in the manufacture of cosmetics-Emulsification, Mixing, compaction, Molding, Packing.
- c) General principles of quality control of herbal cosmetics

UNIT - III

Skin care Products: Physiology and chemistry of skin, Method of preparation, pharmaceutical and Pharmacological evaluation procedures for various formulations like Creams, Lotions, Lipsticks, Face packs. Elaborative study of five formulations under each category with regard to their composition and claims for various herbs used in them.

UNIT - IV

Hair care Products: Hair structure and its chemistry

Method of preparation, pharmaceutical and Pharmacological evaluation procedures for various formulations like Hair dyes, Creams, Oils and Shampoos. Elaborative study of five formulations under each category with regard to their composition and claims for various herbs used in them.

UNIT - V

Herbs in cosmetics:

A brief account of following herbals or herb extracts or herbal products of cosmetic importance such as Acacia concinna pods, Aloe Vera, Almond oil, Neem, Citrus aurantium peels, Henna, Turmeric, Liquorices, Olive oil, tea tree oil and wheat germ oil with special emphasis on their source, active principles and cosmetic properties.

REFERENCE BOOKS:

1. Cosmetics- Formulation, Manufacturing and Quality control –P.P. Sharma
2. Herbal Cosmetics Hand Book- H. Panda
3. Herbal Cosmetics by P.K Chattopadhyay
4. The Complete Technology Book on Herbal Perfumes and Cosmetics by H. Panda

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

PHARMACEUTICAL MANAGEMENT (Professional Elective - III)

Course Objective: The topics which are present in the pharmaceutical management are very much useful to the students in personality development become a perfect pharma professional.

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

- CO 1. Understand the principles and processes of pharmaceutical management, including planning, organizing, staffing, directing, coordinating, and controlling.
- CO 2. Learn the fundamental concepts of production, finance, personnel, legal, and marketing functions in pharmaceutical management, along with budgeting, costing, and entrepreneurship development.
- CO 3. Understand different types of organizational structures and the functioning of various pharmaceutical units, including hospitals, bulk drug, formulation, and testing labs.
- CO 4 Gain knowledge of professional management skills, leadership, decision-making, personnel management, and time management in pharmaceutical organizations.
- CO 5. Manage industrial relations, motivation, communication, conflict resolution, and stress within pharmaceutical organizations.

UNIT I

Pharmaceutical Management: Meaning, Evolution-scientific, administrative and human relation approach. Process of management: Planning, organizing, staffing, directing, coordinating and controlling—a preliminary idea of concepts, processes and techniques.

UNIT II

Fundamental concepts of production, financial, personal, legal and marketing functions with special reference to Pharmaceutical Management. Introduction to budgeting, costing, accounting, auditing, and budgetary control. Entrepreneurship development.

UNIT III

Understanding organizations: Meaning, process, types of organization structures and departmentation, line/staff authority, promoting organizational culture. Organizations, pharmaceutical services and functioning of hospital pharmacy, bulk drug unit, formulation unit, Ayurvedic and Unani manufacturing units and testing labsetc.

UNIT IV

Professional Mangers; Tasks, responsibilities and skills needed. Leadership; Styles and managing change. Decision Making; Types, procedures, evaluation and selection of alternatives, decision making under various situations. Management information and decision support systems and time management.

Personnel Management: Job Analysis, recruitment, selection, orientation and training, performance appraisal and compensation. Retrenchment, lay off and discharge.

UNIT V

Management of Industrial Relations: Industrial disputes, settlement of disputes through various routes such as bargaining, etc.

Motivational aspects, theories of motivation, group dynamics, rewards and incentives, interpersonal skills, significance of communication, its processes, measures for effective communication, conflict management. Stress management.

TEXT AND REFERENCE BOOKS:

1. Marketing Management by Philip Kotlar; Prentice-Hall of India Ltd., New Delhi.
2. Management and Organization by Louis A. Allen; McGraw Hill, Tokyo.
3. Corporate Strategy by Ansoff, H.T.; McGraw Hill, New York.
4. Modern Management by Hempran David R.; McGraw Hill, New York.
5. Management by Stoner and Freeman; Prentice Hall, New Delhi.
6. Motivation and Personality by Maslow, Abraham, Harper &Row, New York.
7. Management of Organizational Behavior, Utilizing the Human Resources by Harcey, Paul and Blanchard Kenneth; Prentice Hall of India, New Delhi
8. Organization Structure, Process and out comes Vth Edition Richard. H. Hall
9. Principles and Methods of Pharmacy Management 3rd Edition Harry A. Smith.
10. Management "Global Perspective Heinz Wehrich, Harold Koontz by Tata Mcgraw Hill".
11. Personnel Management and Industrial Relations by P. C.Tripathi.
12. Pharmaceutical Industrial Management by G. Vidya Sagar, Pharmamed Press.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

NANO BASED DRUG DELIVERY SYSTEMS (Professional Elective - IV)

Course Objective - To develop expertise regarding suitability and evaluation of nanomaterials, able to apply the properties to the fabrication of nano pharmaceutical, evaluate the intensity of dosage forms and availability for targeting and controlled delivery.

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

- CO 1. Understand the fundamentals of nanotechnology, its properties, classification, and marketed nanoparticle-based products.
- CO 2. Learn methods for synthesizing different types of nanoparticles and self-assembled nanostructures.
- CO 3. Gain knowledge of biomedical applications of nanotechnology, including diagnostics and targeted therapies.
- CO 4. Design nanomaterials for various drug delivery systems, including cancer and cardiovascular therapies.
- CO 5. Learn key techniques to characterize nanomaterials and assess their stability and drug release properties.

UNIT - I – Introduction to Nanotechnology

- a. Definition of nanotechnology
- b. History of nanotechnology
- c. Unique properties and classification of nanomaterials
- d. Role of size and size distribution of nanoparticles properties.
- e. Marketed formulations based on nanotechnology and science behind them

UNIT - II – Synthesis of Nanomaterials Physical, chemical and biological Methods Methods for synthesis of

- Gold nanoparticles
- Magnetic nanoparticles
- Polymeric nanoparticles
- Self – assembly structures such as liposomes, Niosomes, transferosomes, micelles, aquasomes and nanoemulsions

UNIT - III - Biomedical applications of Nanotechnology

- a. Nanotechnology products used for in vitro diagnostics
- b. Improvements to medical or molecular imaging using nanotechnology
- c. Targeted nanomaterials for diagnostic and therapeutic purpose

UNIT - IV

Design of nanomaterials for drug delivery, pulmonary and nasal drug delivery, nanomaterials for cancer therapy and cardiovascular diseases. Localized drug delivery systems.

UNIT - V

Characterization of nanomaterials- Size, Zeta potential, PDI, Size separation, Surface morphology, Internal structure, stability, Methods of analysis-Zeta sizer, SEM, TEM and XRD and Drug release studies.

TEXT AND REFERENCE BOOKS:

1. Nanomedicine and Nanoproducts: Applications, Disposition and Toxicology in the Human body, Eiki Igarashi, CRC press. 2015
2. Nanotechnology and Drug Delivery Volume one and two: Nanoplatfroms in Drug Delivery, Jose L. Arias, CRC press
3. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
4. Nanocrystals: Synthesis, Properties and Applications, C. N. R. Rao, P. J. Thomas and G.U. Kulkarni, Springer (2007)
5. Nanostructures and Nanomaterials: Synthesis, Properties and Application, Guozhong Gao, Imperial College Press (2004)
6. Nano-Carrier Systems Theories, Methods & Applications, Amit K. Goyal, Goutam Rath, Pharmamed Press.
7. Nano chemistry: A Classical Approach to Nanomaterials – Royal Society for Chemistry, Cambridge, UK (2005)
8. Nanocomposite science and technology, pulickel M. Ajayan, Linda S. Schadler, paul V. Braun, Wiley - VCH Verlag, Weiheim (2003)
9. Nanoscale materials in chemistry, Edited by Kenneth J. Klabunde, John Wiley & Sons, 2009
10. Nanoparticles as Drug carriers, Vladimir P Torchiling, Imperial College Press, USA, 2006
11. Introduction to Nano Science and Technologies, Ankaneyulu Yerramilli, BS Publications. 2016

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

NUTRACEUTICALS (Professional Elective - IV)

Course Objectives: The students will expose to characteristic features of various phytochemicals as nutraceuticals in various diseased conditions and also know the role of antioxidant in free radical induced disease conditions and will expose to various food laws and regulations.

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

- CO 1. Understand the definitions, classification, sources, and health benefits of functional foods, nutraceuticals, and dietary supplements.
- CO 2. Identify and explain key phytochemicals used as nutraceuticals, including carotenoids, flavonoids, sulfides, polyphenolics, prebiotics, probiotics, phytoestrogens, and tocopherols.
- CO 3. Gain knowledge of free radicals, their formation, and methods for measuring oxidative stress in biological systems.
- CO 4 Understand the role of free radicals in various diseases, the body's antioxidant defense systems, and the use of synthetic antioxidants.
- CO 5. Learn about food laws, safety regulations, and labeling claims for nutraceuticals and dietary supplements, including FDA, FPO, MPO, AGMARK, HACCP, and GMP guidelines.

UNIT I

- a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer etc.
- b. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods:
Spirulina, Soya bean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT II

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following

- a) Carotenoids- α and β -Carotene, Lycopene, Xanthophylls, lutein
- b) Sulfides: Diallylsulfides, Allyltrisulfide.
- c) Polyphenolics: Resveratrol
- d) Flavonoids- Rutin, Naringin, Quercetin, Anthocyanidins, catechins, Flavones
- e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillum
- f) Phytoestrogens: Isoflavones, daidzein, Geobustin, lignans
- g) Tocopherols

UNIT III

- a. Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.
- b. Measurement of free radicals: Lipid peroxidation products, lipid hydroperoxide, malondialdehyde.

UNIT IV

- a. Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.
- b. Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence,

Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α - Lipoic acid, melatonin

c. Synthetic antioxidants: Butylatedhydroxy Toluene, Butylatedhydroxy Anisole.

UNIT V

Food Laws and Regulations; FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

Regulations and Claims – Current Products: Label Claims, Nutrient Content Claims, Health Claims, Dietary Supplements Claims

REFERENCE BOOKS:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and nutraceuticals in preventing diseases by K. T. Agusti and P. Faizal: BS Publication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F. Balch and Phyllis A. Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C. Williams Editors *2000 Functional foods* Woodhead Publ. Co. London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M. K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

CLINICAL RESEARCH AND PHARMACOVIGILANCE (Professional Elective - IV)

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. Understand the regulatory and ethical guidelines for clinical trials, including ICH-GCP principles and informed consent.
- CO 2. Explain different types and designs of clinical trials and the roles of personnel involved in conducting them.
- CO 3. Understand clinical trial documentation, including protocols, case report forms, safety monitoring, and management of adverse drug reactions.
- CO 4. Learn the basics of pharmacovigilance, including its history, significance, international programs, and establishment of PV centers.
- CO 5. Describe methods and tools for ADR reporting, including active and passive surveillance, regulatory reporting systems, and statistical evaluation of 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 Nonproprietary 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. A Textbook of Clinical Research and Pharmacovigilance by KPR Chowdary, Pharmamed Press.
7. Handbook of clinical Research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone.
8. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
9. Textbook of Pharmacovigilance: Concept and Practice. G.P. Mohanta and P. K. Manna. 2016, Pharma Med Press.
10. A textbook of Clinical Pharmacy Practice: Essential Concepts and Skills. Second Edition, 2012, University Press

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

MODERN PHARMACEUTICS – II LAB (Laboratory- III)

Course Outcomes: Upon completion of the subject student shall be able to

- CO 1. Perform scale up calculations from R&D to pilot plant for various unit operations.
- CO 2. Prepare injectables, ampoules, vials.
- CO 3. Prepare ophthalmic products, eye drops and eye ointments.
- CO 4. Prepare dry powder inhalations and demonstration of DPI of marketed products.
- CO 5. Formulate aerosols and demonstration of products.

List of Experiments:

1. Scale up calculations from R&D to pilot plant for the following unit operations
 - a) Wet granulations using RMG/PLM
 - b) Blending & Lubrications
 - c) Film coating
2. Preparation of Injectables, Ampoules & Vials
3. Preparation of Ophthalmic products, Eye drops and Eye ointments
4. Preparation of Dry powder Inhalations
5. Formulation Development and Demonstration of function of DPI of marketed products
6. Formulation of Aerosol Demonstration of marketed products

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutics)

ADVANCED DRUG DELIVERY SYSTEMS LAB (Laboratory- IV)

Course Outcomes: Upon completion of the subject student shall be able to

- CO 1. Design formulate and evaluate microparticulate formulations.
- CO 2. Formulate and evaluate sustained release systems.
- CO 3. Know the effect of drug diffusion through various types of polymeric membranes.
- CO 4. Compare various marketed formulations by in vitro drug release studies
- CO 5. Formulate and evaluate enteric coated tablets

List of Experiments:

1. Study on diffusion of drugs through various polymeric membranes (2 experiments)
2. Formulation and Evaluation of sustained release Oral Matrix Tablet (2 experiments)
3. Formulation and Evaluation of sustained release Oral Reservoir System (2 experiments)
4. Formulation and Evaluation of Microspheres / Microencapsules (2 experiments)
5. Study of in-vitro Dissolution of various SR products in market (2 experiments)
6. Formulation and Evaluation of Transdermal Films (2 experiments)
7. Formulation and Evaluation of Mucoadhesive System (2 experiments)
8. Preparation and Evaluation of Enteric Coated Pellets / Tablets (2 experiments)
9. Preparation and Evaluation of Liposomes, Niosomes and Nanoparticles

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm II Year I Sem (Pharmaceutics)

BIOSTATISTICS (Professional Elective - V)

Course Objectives: 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, Poison 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 (Pharmaceutics)

SCALE UP AND TECHNOLOGY TRANSFER (Professional Elective - V)

Course Objectives: 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.

5. Tablet machine instruments in pharmaceuticals, PR Watt, John Wiloy.
6. Pharmaceutical dosage forms, Tablets, Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
7. Pharmaceutical dosage forms, Parenteral medications, Vol 1, 2 by K.E. Avis, Marcel 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, Dehli.\
10. Pharmaceutical Process Scale-up 2nd Ed. Levin Michael, CRC press

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm II Year I Sem (Pharmaceutics)

PRODUCTION AREA DESIGN & PACKAGING DEVELOPMENT
(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 Outcomes: Upon completion of the course a learner shall be able to

- CO 1. Understand plant location, production area design, utilities, and material handling for various dosage forms including solids, semisolids, injectables, and nutraceuticals.
- CO 2. Learn current Good Manufacturing Practices (GMP) for building design, clean rooms, HVAC systems, cross-contamination control, and documentation requirements.
- CO 3. Gain knowledge of pharmaceutical packaging systems, materials, components, labeling, and package design research.
- CO 4 Understand packaging stability, regulatory requirements, and pharmaceutical stability testing, including ICH guidelines and photo stability studies.
- CO 5. Describe packaging strategies for solids, semisolids, parenterals, ophthalmic products, and aerosols, including material selection, inspection, storage, and labeling.

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
 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

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm (Pharmaceutics)

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 (Pharmaceutics)

DISASTER MANAGEMENT (Audit Course - I & II)

Prerequisite: None

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.

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm (Pharmaceutics)

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 BOOKS/ REFERENCES:

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 (Pharmaceutics)

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. 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/ REFERENCES:

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 (Pharmaceutics)

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.

SUCP

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm (Pharmaceutics)

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.

SUCP

**SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD
M.Pharm (Pharmaceutics)**

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`t's 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 Tarining-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 (Pharmaceutics)

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: Chapter 2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter 2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter 18 – 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.