Syllabus

Degree of

Master of Pharmacy (Pharmaceutics)

Year- I

Session 2015-16

Syllabus Prescribed for Degree of Master of Pharmacy (Pharmaceutics)

Year- I

Subject Code: MPCS 101

Subject: MODERN ANALYTICAL TECHNIQUES (THEORY) (4hr/week)

1. **UV-Visible Spectroscopy**: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect, Spectrophotometric titrations, Wood ward – Fiesure rule, Applications of UV Visible spectroscopy.

a. Spectroflourimetry**:** Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

b. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2. **InfraRed Spectroscopy**: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies, ATR-IR, Interpretation and Applications of IR spectroscopy

3. **NMR Spectroscopy**: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR with reference to 13CNMR: Spin spin and spin lattice relaxation phenomenon. 13C NMR, 1-D and 2-D NMR, NOESY and COSY techniques, Interpretation and Applications of NMR spectroscopy.

4. **Mass Spectroscopy**: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Tandem Mass Instruments, Interpretation and Applications of Mass spectroscopy.

5 . Chromatography & Electrophoresis

A- Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following:

a. Paper chromatography b) Thin Layer chromatography
b. Ion exchange chromatography d) Column chromatography
c. Gas chromatography f) GC-MS
d. High Performance Liquid chromatography h) LC-MS
e. High Performance Thin Layer chromatography
f. Super critical fluid chromatography l) Affinity chromatography

B- Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:

a. Paper electrophoresis
b. Gel electrophoresis
c. Capillary electrophoresis
d. Zone electrophoresis
e. Moving boundary electrophoresis
f. Iso electric focusing

6**. Other analytic Techniques**

a. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law,Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction.
b. Optical Rotatory Dispersion: Principle, Plain curves, Cotton effect, Circular Dichroism, Measurement of rotaion angle in ORD and applications
c. Radioimmunoassay: Importance, various components, Principle, Differentmethods, Limitation and Applications of Radio immuno assay.

7. **Statistical Analysis:** Introduction, Significance of statistical methods, normaldistribution, probability, degree of freedom, standard deviation,

correlation,variance, accuracy, precision, classification of errors, reliability of results,confidence interval, test for statistical significance – Students T test, F test, Chisquare test, Correlation and regression.

References Books

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Fundamentals of Statistics – Elhance, Kitab Mahal.
3. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
4. Vogel's Text book of quantitative chemical analysis - Jeffery, Basset, Mendham, Denney, 5th edition, ELDS, 1991.
5. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
6. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
7. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
8. Quantitative analysis of Pharmaceutical formulations by HPTLC - P D Sethi, CBS Publishers, New Delhi.
9. Pharmacutical Analysis - Higuchi, Brochmman and Hassen, 2nd Edition, Wiley – Interscience Publications, 1961.
10. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
11. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series
12. Analytical Profiles of Drug substances – Klaus Florey, Volume 1 – 20, Elsevier, 2005

13. Analytical Profiles of Drug substances and Excipients – Harry G Brittain, Volume 21 – 30, Elsevier, 2005.

Subject Code: MPCS-101

MODERN ANALYTICAL TECHNIQUES (PRACTICAL)

Minimum 15 experiments to be conducted
1. Use of UV Vis spectrophotometer for analysis of pharmacopoeial compounds and their formulations (4 Experiments).
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry.
(4 Experiments).
3. Effect of pH and solvent on UV spectrum of certain drugs.
4. Experiments based on HPLC and Gas Chromatography (2 Experiments)
5. Experiments on factors affecting the absorbance/fluorescence in UV spectroscopy/Fluorimetry.
6. Separation and quantitative analysis of various components by TLC and HPTLC techniques (1
Experiment in each technique)
7. Interpretation of IR, NMR and MASS spectra (2 compound each)
8. Gradient elution and other technique in column Chromatography (Minor Experiment)
9. Separation by electrophoresis

MPCS-102

PREFORMULATION AND PRODUCTION MANAGEMENT (THEORY)

1. **Preformulation Studies, Compaction, Compression, and Consolidation**

Introduction , Consideration of physico-chemical properties of new drug molecules for different dosage forms. Aqueous solubility, organic solubility, intrinsic solubility, methods of enhancement of solubility-surfactants, pH, co-solvency, solid dispersion, complexation. Techniques for the study of crystal properties and polymorphism - DSC, TGA, PXRD, Optical microscopy, hot stage microscopy. Excipient compatibility studies, Preformulation stability studies. Compression, consolidation, decompression, compaction of powders with a particular reference to distribution and measurement of forces within the powder mass undergoing compression. Influence of compression force on the properties of tablets. Effect of particle size, moisture content, lubrication etc. on strength of tablets. Recent advance in Tablet Technology and automation in manufacturing process formulation and evaluation of dispersible, effervescent, floating and multilayer tablets.

Active Pharmaceutical Ingredients and Generic drug Product development

Process development, Bulk drugs process design, Design and construction of facilities, Plant operation.

Solid oral dosage form- Introduction, Active pharmaceutical ingredients, Experimental formulation development, Drug product performance, Pharmaceutical alternative consideration for generic substitution

2. **Quality By Design, Design Of Experiments, Formulation By Design And Stability Testing**

USFDA's view of QbD, Elements of QbD, QbD tools, Design of experiments –Methods and applications Optimization techniques: Concept of optimization, optimization parameters, classical optimization. Statistical design (Simplex and factorial design), Solid state drug stability, dosage form stability, accelerated stability testing, shelf life calculations, strategies for prolonging shelf life. Effect of packaging materials on dosage form stability. Basic principles of ICH guidline. Stability testing of new drug substance and formulations, photostability testing and oxidative stability, role of containers in stability testing. WHO stability guidelines.

Sterilization Process& Aseptic technology

Principle, Advantages, Disadvantages, Applications of different sterilization methods, Equipments, Steam quality testing, Sterile area monitoring system, Inprocess control, Broth fill trails, Sterile validation, Sterile area maintenance – sterile Filling, Rubber Bung placement, Flip off seal placement, Labelling, Validation of autoclaves, DHS, Tunnel, Vial/Ampoule washing, Bungs (Rubber Stopper) processing. Daily operation management of sterile equipment of autoclave- leak test, steam penetration study for clothing and porous load. Chemical Indicators and Biological Indicators and determination of Cold spots in the autoclave. Load selection criteria for autoclaves. Steam quality testing methods and Limits.

Aseptic Filtration technique – Filter selection and compatibility, Qualification of Filter, Bubble point testing, Documentation – Batch Manufacturing Record, Batch Packing Record, Sterilization data sheet (retention of Washing equipment data and autoclave, Dry Heat Sterilizer or Tunnel thermographs).Sterility testing: Principle, general procedure, control tests,

3. **cGMP, ISO 9000 & 14000 Series, Validation, Inventory Management**

   ISO 9000 & 14000 series, guide to Pharmaceutical manufacturing facilities, cGMP considerations with emphasis on documentation practices.

   Validation- General concepts, types, approaches to validation and scope of validation. Relationship between calibration, validation & qualification. Validation master plan, qualifications of utilities - HVAC systems, validation of water systems. Validation of manufacturing process for sterile and non-sterile products (briefly protocols and reports), Equipment qualification and cleaning validation.

   Costs in inventory, inventory categories- special considerations, selective inventory control, reorder quantity methods and EOQ, inventory models, safety stock – stock out, lead time – reorder time methods, modern inventory management systems, inventory evaluation.

4. **IPR, Regulatory Guidelines, Manufacturing operations and Control, GMP Considerations & Documentation and records**

   Definition, Need for patenting, Types of Patents, Conditions to be satisfied by an invention to be patentable, Introduction to patent search. Parts of patents. Filling of patents. The essential elements of patent; Guidelines for preparation of laboratory note book, Non-obviousness in Patent. Brief introduction to Trademark protection and WHO Patents. IPR's and its types, Major bodies regulating Indian Pharmaceutical sector, CDSCO. WHO, USFDA, EMEA, TGA, MHRA, MCC, ANVISA regulatory requirements for contract research organization. Regulations for Biosimilars, Role of GATT, TRIPS, and WIPO.

   Sanitation of Manufacturing premises, Mix-ups and Cross contaminations processing of intermediates and Bulk Products, Packaging operations, IPQC in manufacturing and Packaging, Release of finished products, process deviation, Charge-in of components, Time limitations on production, Drug product inspection, Expiration dating, Calculation of yield, Production record review, Documents title, SOP, Online clearance and its records, SOP on internal labeling, SOP of time limitation on production, Formats for area clearance/ machine clearance, Temperature and relative humidity record, Tablet compression tooling, Dye punch use log, Dye punch cleaning record, Batch movement record for various dosage forms, Over printing line clearance sheet, Packaging operation and inspection record, Packaging line clearance record.

5. **Current Good manufacturing practices:** Manufacturing facilities for tablets, capsule, liquid orals, semisolids and parenterals as per schedule M. Certification for

pharmaceutical industries, US federal standard 209 E: Class designation, testing and monitoring reports, calibrations, URS,FAT,DQ, SAT, IQ, OQ, PQ of machines and equipment, WHO GMP minimum document check list, Schedule U and U1. Master

formula record as per WHO GMP and US FDA. Drug Master files US FDA, Preparation for WHO GMP audit, preparation of Site Master File,environment management system clauses. Technology transfer guidance.

6. **Material Management and Pilot Plant Scale Up Techniques, Industrial Hazards and Plant Safety**

   Materials–quality and quantity, value analysis, purchasing–centralized and decentralized, vendor development, buying techniques, purchasing cycle and procedures, stores management, salvaging and disposal of scrap and surplus. Selection of material handling systems, maintenance of material handling equipment, unit-load, pelletization and containerization, types of material handling systems. Scale up of batches for product development, layout of pharmaceutical pilot plant, organization structure, personnel, activities. Pilot plant of solids, semisolids, and liquid dosage form. Protocols for technology transfer.

   Industrial accidents, mechanical hazards, electrical hazards, chemical hazards, gas hazards, dust explosion, fire and explosion hazards, prevention and control of all these hazards, safety management. Industrial pollution and Control measurements. Capsules, solutions, dispersions, semisolids, and parenteral. Protocols for technology transfer.

7. **Packaging of Pharmaceuticals**

   Pharmaceutical dosage form and their packaging requirments, Pharmaceutical packaging materials, Medical device packaging, Enteral Packaging, Aseptic packaging systems, Container closure systems, Issues facing modern drug packaging, Selection and evaluation of Pharmaceutical packaging materials.

Reference Books

1. Theory and Practice of Industrial Pharmacy By Lachmann and Libermann
2. Modern Pharmaceutics by Gillbert and S. Banker 4th Edition .
3. Pharmaceutical Process Validation: By Fra R. Berry and Robert A. Nash, Vol 57, 2nd edition
4. Applied Production and Operation Management By Evans, Anderson and Williams GMP for pharmaceuticals Material Management by K.K. Ahuja Published by CBS publishers
5. Pharmaceutical Preformulations by J.J Wells
6. Pharmaceutical Dosage Forms: Tablets vol 1-3 by Leon Lachmann
7. Text book of Remington's Pharmaceutical sciences Vol I and II, 21st edition
8. Physical Pharmaceutics by Alfred Martin, 4th edition

9. Bentley's textbook of Pharmaceutics-Rawbins
10. ISO 9000-Norms and explanations
11. GMP for pharmaceuticals- Willing S.H. Marcel and Dekker
12. Pharmaceutical powder compaction technology by Goran Alderborn, 1996. Marcel and Dekker
13. D and C act by Vijay Malik, Latest edition, Eastern book company, Lucknow

Subject Code: MPCS-102

PREFORMULATION AND PRODUCTION MANAGEMENT (PRACTICAL)

1. Preformulation study of tablet formulation using various diluents
2. Preformulation study of tablet formulation using various binders.
3. To study the effect of surfactants/Co-solvents on the solubility of drugs.
4. To study the effect of various excipients on the compressibility of tablets.
5. Preparation and evaluation of Diclofenac sodium gel containing different gel bases.
6. Study of the effects of pH on rheological characteristics of carbopol gels using Brookefield viscometer.
7. cGMP considerations for tablets.
8. cGMP considerations for injectables.
9. Preparation and comparative evaluation with marketed product for efficiency of neutralizing property of antacid suspensions.
10. Process validation of tablets.
11. Equipment qualification of an analytical instrument.
12. Equipment qualification of processing equipment.
13. Cleaning validation of an equipment.
14. Designing of plant layouts for tablets and parenterals.
15. Stability studies of dosage form at 30^0C±2, 65±5 %RH and 40^0C±2, 75±5% RH.

MPCS-103

Subject: BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)

1. **Absorption of Drugs and Bioavailability**
   Structure of cell membrane, Gastro-intestinal absorption of drugs, mechanisms of drug absorption, Factors affecting drug absorption: Biological, Physiological, Physico-chemical and Pharmaceutical. Absorption of drugs from non-per oral routes, Methods of determining absorption: *In-vitro, in-situ* and *in-vivo* methods.

2. **Objectives and consideration in bioavailability studies:** Concept of equivalence, Measurement of bioavailability, Determination of the rate of absorption, Bioequivalence protocol and its importance, Bioequivalence studies.

3. **Dissolution and Pharmacokinetics:** BCS Classification, Noyes-Whitney's dissolutions rate law, Study of various approaches to improve dissolution of poorly soluble drug, *In-vitro* dissolution testing models, *In-vitro* release kinetic models, similarity and dissimilarity factors, biowaivers,

4. **In-vitro- In –vivo correlation :**Basic considerations, Pharmacokinetic models, Compartment modeling: One compartment model - IV bolus, IV infusion, Extravascular; Multi Compartment models; Two compartment model - IV bolus, IV infusion, Extravascular, Three Compartment model in brief, Application of Pharmacokinetics in new drug development and designing of dosage forms and Novel drug delivery systems.

5. **Non-Linear and Non-Compartment Pharmacokinetics**
   Causes of non-linearity, Detection of non – linearity, Michaelis-Menten equation, Estimation of K_m and V_{max} with respect to individualization of a drug therapy. Statistical moment theory, MRT for various compartment models, Physiological pharmacokinetic models.

6. **Drug Distribution and Biotransformation** Factors affecting drug distribution, Volume of distribution, Protein binding- factors affecting, significance and kinetics of protein binding and drug displacement interactions. Phase I (oxidative, reductive and hydrolytic reactions) and Phase II reactions (conjugation), factors affecting biotransformation.
7. **Excretion of Drugs and therapeutic response and toxicity**
   Renal and non-renal excretion. Concept of clearance- renal clearance, organ clearance and hepatic clearance. Multiple dosing with respect to I.V and oral route, concept of loading dose, maintenance dose, accumulation index, adjustment of dosage in renal and hepatic impairment, individualization of therapy, Therapeutic Drug Monitoring. Dosage Regimen, concentration and response, therapeutic concentration range, therapeutic index, therapeutic window, factors affecting plasma concentration and toxicity.

Reference Books

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 4th edition, Philadephia, Lea and Febiger, 1991.
2. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal, Vallabh Prakashan Pitampura, Delhi
3. Applied Biopharmaceutics and Pharmacokinetics by Shargel. L and Yu ABC, 2nd edition, Connecticut, Appleton Century Crofts, 1985.
4. Textbook of Biopharmaceutics and Pharmacokinetics, Dr. Shobha Rani R. Hiremath, Prism Books Pvt Ltd, Bangalore, 2000
5. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 2nd edition, Marcel Dekker Inc., New York,1982.
6. Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, Swarbrick. J, Lea and Febiger, Philadelphia,1970.
7. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
8. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
9. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inc, New York and Basel, 1987.
10. Biopharmaceutics and Relevant Pharmacokinetics by John. G. Wagner and M. Pernarowski, 1st edition, Drug Intelligence Publications, Hamilton, Illinois,1971.
11. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C. Roylan, Marcel Dekker Inc, New York 1996.

MPCS-103

BIOPHARMACEUTICS AND PHARMACOKINETICS (PRACTICAL)

1. Improvement of dissolution characteristics of slightly soluble drugs by Solid Dispersion.
2. Improvement of dissolution characteristics of slightly soluble drugs by Solvent deposition.
3. Improvement of dissolution characteristics of slightly soluble drugs by complexation.
4. Improvement of dissolution characteristics of slightly soluble drugs by solvent evaporation.
5. Comparison of dissolution studies of two different conventional marketed products of same drug. - 2 experiments
6. Influence of polymorphism on solubility.
7. Influence of polymorphism on dissolution.
8. Protein binding studies of a highly protein bound drug.
9. Protein binding studies of a poorly protein bound drug.
10. Permeation study of drug through biological membrane.
11. Calculation of Ka, Ke, $t_{1/2}$, C_{max}, and T_{max} for two sets of data. -2 experiments
12. Calculation of bioavailability from urinary excretion data for two drugs. -2 experiments
13. Calculation of AUC and bioequivalence from the given data for two drugs. -2 experiments

MPCS-104

ADVANCE PHARMACEUTICS (THEORY)

1. **Concepts of Controlled Release Drug Delivery Systems and Polymer Science**
   Introduction, rational, classification and various carrier for CDDS, advantages & disadvantages of CDDS. Factors to be considered for designing controlled release dosage forms. Dissolution, Diffusion, Combination of dissolution and diffusion controlled drug delivery systems. Evaluation of CRDF.

2. **Polymer: Introduction, classification :**General Synthesis and Evaluation Techniques. Application of polymers in drug delivery. A detail account of biodegradable polymers.

3. **Approaches To Controlled and Muco Adhesive Drug Delivery System :**
   Classification of rate-controlled drug delivery systems. Rate-programmed release, activation-modulated and feedback regulated drug delivery systems. Effect of system parameters on controlled drug delivery. Hydrodynamically balanced systems, Osmotic pressure controlled, pH controlled, ion exchange controlled systems.Concepts, advantages and disadvantages, structure of oral mucosa, transmucosal permeability, theories of muco adhesion and muco adhesive polymers, mucosal membrane models, permeability enhancers. Development and evaluation of buccal, nasal, pulmonary, rectal, vaginal and ocular drug delivery systems and their applications.

4. **Transdermal and Parenteral Controlled Release Drug Delivery Systems**
   Rationale behind transdermal drug delivery, Permeation through skin, factors affecting permeation, basic components of TDDS, formulation approaches used in development of TDDS and their evaluation, permeation enhancers. Iontophoresis, sonophoresis and magnetophoresis.

5. **New Approaches for Controlled Release Formulations:**
   Approaches for injectable controlled release formulations. Development and evaluation of Implantable drug delivery systems, subcutaneous, intramuscular and intrauterine implants.

6. **Nano Drug Delivery Systems:**
   General consideration, development, formulation and evaluation of Nanoparticles-Polymeric nano particles, Nano crystals, Solid Lipid Nanoparticles (SLN), Metal Nanoparticles, Multiple Emulsion, Vesicular Systems-Liposomes, Transferosomes, Ethosomes, Niosomes, Virosomes. Carbon Nano Tubes (CNT) and Dendrimers. Peptide and protiens drug delivery. Safety issues related to nano drug delivery systems.

7. **Targeted Drug Delivery:**
   Concept, types of targeting and applications, advantages and disadvantages. Monoclonal antibodies - hybridoma cell production, diagnostic and therapeutic applications – cancer and autoimmune diseases. Problems related to monoclonal antibodies.

Reference Books

1. Chien YW., Novel drug delivery systems, 2nd edition, revised and expanded, Marcel Decker, Inc., New York, 1992.

2. Robinson JR., Lee VHL. Controlled drug delivery systems, Marcel Decker, Inc., New York,1992.

3. John Wiley and sons, Inc, Encyclopedia of controlled delivery, Editor-Edith Mathiowitz, Published by Wiley Interscience Publication, New York/Chichester/Weinheim

4. Jain NK., Controlled and novel drug delivery, CBS Publishers & Distributors, New delhi,First edition 1997 (reprint in 2001)
5. Vyas SP., Khar RK., Controlled drug delivery-concepts and advances, Vallabh Prakashan, New Delhi, first edition 2002.

6. Indian Pharmacopoeia 2010. Volume-I, II & III, Indian Pharmacopoeia Commission.

7. United States Pharmacopoeia, US Publications, USA

8. British pharmacopoeia

9. Howard C. Ansel, Nicholas G., Popovid loyd, Allen junior BI. Pharmaceutical dosage forms & drug delivery systems. Waverly pvt, Ltd, New Delhi, Sixth edition

10. Leon Lachman, Lieberman, Kanig JL., Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Bombay, 3rd Edition, 1987.

11. Banker and Rhodes, Modern Pharmaceutics, Marcel Decker Inc., New York, 2nd Edition, 1990.

12. Ansel HC., Introduction to Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams and Wilkins, New York, 7th Edition, 2000.

13. Remington, the Science and Practice of Pharmacy, Lippincott Williams, 21st Edition, 2000.

14. Patrick J. Sinko. Lippincott Williams and Wilkins. Martin's physical pharmacy and pharmaceutical sciences. Fifth edition.

15. Wilium Alfred Martin P, Bustamante AH., Chun. Physical Pharmacy, B. I. Waverly Pvt Ltd, new Delhi, 4th edition 1995

16. S.Bharath. Pharmaceutical Technology-Concepts and Applications, Pearson Education in South Asia, First edition,2013.

MPCS-104

ADVANCE PHARMACEUTICS (PRACTICAL)

1. Comparative evaluation of marketed sustained release tablets and data treatment.
2. Preparation and evaluation of matrix tablets using natural polymers.
3. Preparation and evaluation of matrix tablets using synthetic polymers.
4. Preparation and evaluation of microspheres by solvent evaporation.
5. Preparation and evaluation of muco- adhesive microspheres by ionic gelation method.
6. Preparation and evaluation of microspheres by temperature change method.
7. Preparation and evaluation of microcapsules by wax embedded method.
8. Preparation and evaluation of buccal patches.
9. Preparation and evaluation of buccal tablets.
10. Preparation and evaluation of transdermal films.
11. Evaluation of the effect of various permeation enhancers on transdermal drug delivery.
12. Preparation and evaluation of hydrodynamically balanced tablets.
13. Preparation and evaluation of ocular *insitu* gel.