B.PHARM VII SEMESTER

COURSE NO 701: PHARMACEUTICAL CHEMISTRY-VI (NATURAL PRODUCTS)

Learning objectives:

1. To let students to understand the role of natural chemistry in drug discovery
2. To make students understand the intricacies of natural product isolation and identification using chemical tests, degradative methods and spectroscopy.
3. To expose students towards different chemical classes of natural products and their relationships according to their biological activity.

Units	Contents	Hrs
Unit-1:	Carbohydrates: Classification and general properties. Knowledge of structure including stereochemistry of glucose, fructose, and sucrose. General treatment of pharmaceutically important carbohydrates-maltose, lactose, starch, cellulose, dextrin, and glycosides.	**08**
Unit-2:	Amino acids and proteins: Classification and general reactions of amino acids and their relationship to proteins and polypeptides. Methods of preparation of amino acids, classification and general reactions of proteins, degradation of proteins-hydrolysis and end group analysis-protein hormones, oxytocin.	**10**
Unit-3:	Purines and xanthine derivatives: Structure and synthesis of uric acid, Theo bromine, theophylline, and caffeine. General aspects of nucleoproteins and nucleic acids, Lipids: Fixed oils and fats. Fatty acids: chemistry and analysis of oils and fats.	**08**
Unit-4:	Terpenes: Occurrence, general methods of isolation and classification, chemistry of citral, limonene, ∝-terpeneiol, carvone, camphor and menthol. Preparation, general composition, properties and analysis of essential oils of I.P. Alkaloids: Classification, general methods of isolation, chemical tests for alkaloids, Chemistry and uses of ephedrine, nicotine, papaverine and atropine.	**08**
Unit-5:	Vitamins: Classification, chemistry, physiological role and uses of thiamine, riboflavin and ascorbic acid. Skeletal structures of vitamins official in I.P. Steroids: Nomenclature and skeletal structures of ergosterol, stigmasterol, cholsterol and bile acids. Chemical tests for steroids. Calciferols and Sapogenins – diosgenin, hecogenin	**07**

Unit-6:	Hormones: Sex hormones, structure and physiological properties of testosterone, progesterone, estrone, estriol and estradiol. Their synthesis from cholesterol or diosgenin. Synthetic estrogens. Introduction to oral contraceptives. Cortisones; prednisolone, aldosterone, synthesis of cortisone. Steroidal anti-inflammatory drugs: structures and their therapeutic uses.	**06**
Unit-7:	Glycosides: Enzymatic and hydrolysis reactions of glycosides, mechanism of action, SAR, therapeutic uses and toxicity of glycosides. Cardiac glycosides of digitalis, bufa and squill. Structure of salicin, hesperidin and rutin.	**07**
Unit-8:	Antibiotics: A general study of antibiotics, isolation or synthesis, chemistry and uses of penicillin, chloramphenicol and streptomycin, general introduction to tetracycline and other antibiotics included in I.P. Spectroscopy and structure: an introductory treatment of U.V., I.R. and NMR spectroscopy in structure deterimination.	**06**

SUGGESTED BOOKS

1. Organic chemistry, Vol. II. By I.L. Finar
2. Wilson and Gisvold, Textbook of Organic, Medicinal and Pharmaceutical Chemistry
3. Bently and Driver's Textbook of Pharmaceutical chemistry
4. Remington's Prtactice of Pharmaceutical Sciences
5. Indian Pharmacopoeia.

COURSE NO 702: PHARMACEUTICAL CHEMISTRY-VI (NATURAL PRODUCTS)

PRACTICAL

1. Determination of acid value
2. Determination of saponification value
3. Determination of iodine value
4. Determination of unsaponifiable matter
5. Determination of Eugenol in clove oil
6. Estimation of cineole in eucalyptus oil
7. Estimation of citral in lemon grass oil
8. Determination of aminophylline
9. Determination of caffeine citrate
10. Estimation of strychnine hydrochloride
11. Tests for absence of arachis oil, cottonseed oil and sesame oil in other oils
12. Reactions of carbohydrates, glycosides, alkaloids, amino acids (including Xanthine alkaloids), sterols and vitamins

13. Identification of selected natural products
14. Preparation of caffeine from Tea dust
15. Preparation of caseine and estimation of nitrogen
16. Soxhelt extraction of a crude drug
17. Assay of tincture Nuxvomica/Tincture Belladona

COURSE NO 703: PHARMOCOLOGY-II- THEORY

Learning objectives:

1. To make student understand drug development and concepts of drug action.
2. To know the drugs used in infections and chemotherapy with mechanism of action and pharmacokinetics, uses, side-effects.
3. To know peptides as drugs and role of autocoids in various process and drugs acting on them.

Units	Contents	Hrs
Unit-1:	Chemotherapy: sulphonamides, antibiotics, antiviral, antifungal agents and antineoplastics. Drug treatment in tuberculosis, leprosy, venereal diseases, malaria, filaria, leishmaniasis, trypnasomiasis, amoebiasis and helmenthiasis.	**12**
Unit-2:	Vitamins and hormones: vitamins, thyroid, parathyroid, adrenal cortex, insulin and oral antidiabetic drugs	**08**
Unit-3:	Pharmacology of drugs acting on sex organs: Oral Contraceptives, oxytocic agents and uterine relaxants.	**06**
Unit-4:	Immunity and biological standardisation: vaccines and immune sera, immunosuppressive agents.	**07**
Unit-5:	Methods of biological assay, principles of bioassays, fundamentals of biometric analysis. Detailed study of the official bioassay methods for adrenaline, posterior pituitary, insulin, gonadotrophic hormones, cholera vaccine and diphtheria antitoxin. Tests for pyrogens: LAL Test & rabbit method.	**10**
Unit-6:	Pharmocology of local anaesthetics.	**05**
Unit-7:	Drugs acting on respiratory system: cough suppressants, bronchodilators, drugs used in asthma. Miscellaneous: chelating agents, demulcents, counter-irritants, diagnostic agents.	**06**
Unit-8:	Drugs acting on GI tract: digestants, antispasmodics, anti-diarrhoeal agents, cathartics, emetics, antiemetics, drugs used in inflammatory bowel syndrome, antacids and drugs used in gastric ulcers.	**06**

Text Books:

1.Textbook of Pharmocology by Rang and Dale
2. Essentials of Medical Pharmacology. -KD Tripathi
3.Lippincort's illustrated pharmacology
4.Pharmacology and pharmacotherapeutics by Satoshkar and Bandarkar.

Reference Books:

1. Pharmacological basis of Therapeutics by Goodman and Gillman.
2. Text book of clinical pharmacology –Bertram.C.Katzung
3. Indian Pharmacopoeia.

COURSE NO 704: PHARMOCOLOGY-II- PRACTICAL

List of Practicals:

1. Effect of Adrenaline and Acetylcholine on the rabbit intestine.
2. Effect of Atropine on the action of Acetylcholine on the rabbit intestine
3. Effect of anti-histaminics on the action of histamine on guineapig ileum.
4. Drug antagonism studies on isolated smooth muscle strips Adrenaline × propranolol (receptor antagonism) of rabbit intestine.
5. Bioassay of acetylcholine by Comparative method using Rat Ileum.
6. Bioassay of acetylcholine by Graphical method using Rat Ileum (Indirect Bioassay)
7. Three-point bioassay: Bioassay of acetylcholine by using isolated Rat Ileum Preparation.
8. To find out the Potency ratio between the Standard and test sample of Acetylcholine solution by four point bioassay method using isolated rat ileum
9. Bioassay of histamine on guineapig ileum.
10. Action of drugs on rabbits eye (local anaesthetics).
11. Action of drugs on mice (CNS stimulants).
12. Action of drugs on mice (CNS depressants).
13. Test for Pyrogens: Determination of the Existence of Pyrogens in Parenteral preparations (rabbit method).
14. Hypoglycemic effect of insulin in rabbits.

COURSE NO 705: PHARMACOGNOSY AND PHYTOCHEMISTRY II

Learning objectives:

1. To study the generation of biodrugs in plants as a result of metabolism.
2. To impart knowledge about important chemical classes of compounds having bio activity.

Units	Contents	Hrs
Unit-1:	General Pharmacognosy: Advantages and disadvantages of obtaining drugs from cultivated and wild plants. Variability of drug constituents due to exogenous and endogenous factors like altitude, temperature, rain fall, light, propagation by seed vegetative means, mutation, hybridization;	**08**
Unit-2:	Deterioration of crude drugs during storage by insects, pests and enzymes. Factors influencing the storage of crude drugs. Methods of storage. Evaluation of crude drugs: Identity, purity and quality of crude drugs by organoleptic microscopic, physical, chemical and biological evaluation;	**10**
Unit-3:	Methods of adulteration, detection and identification of adulterants types and significance of standards for crude drugs included in I.P. and B.P. Quantitative pharmacognosy.	**06**
Unit-4:	A detailed study of the following drugs, their classification methods of preparation, commercial varieties, active principles, their chemical nature, identification, tests and uses; Roots and rhizomes :Male fern, valerian, rhubarb, podophyllum, liquorice, turmeric ,ginger, ipecac, rauwolfia, aconite and jalap; Unorganised drugs: opium, aloes, kino, gambier, agar, alginates, gelatin.	**07**
Unit-5:	A detailed study of the following drugs, their classification methods of preparation, commercial varieties, active principles, their chemical nature, identification, tests and uses Resins, gum resins, oleoresins-colophony, benzoin, shellac, myrrh, galbanum, asafetida, turpentine, balsam of Tolu, balsam of Peru and storax;	**08**
Unit-6:	A detailed study of the following drugs, their classification methods of preparation, commercial varieties, active principles, their chemical nature, identification, tests and uses Glands and glandular secretions-thyroid, pituitary, adrenal, pancreas and musk; Gums and saccharin substances: acacia, tragacanth and honey.	**08**
Unit-7:	Chromatography and some related terms. Classification and a study of various chromatographic methods. Column, paper, thin layer and gas chromatography, HPLC and their applications to natural products.	**07**
Unit-8:	Biogenesis; Pathways leading to formation of plant products; Historical development of plant tissue culture, types of cultures,	**06**

	nutritional requirements, growth and their maintenance, applications of plant tissue culture in production of pharmaceutically important secondary metabolites.	

Recommended Books :

1. Atal CK and Kapoor BM. Cultivation and utilization of Aromatic Plants. CSIR Publications;
2.Tyler,VC,Brady,LR and Robers,JE.Pharmacognosy.,11th to 14th Editions;
3.Wallis,TE.Textbook of Pharmacognosy,5th Edition,J & A,Churchill Limited, U.K. 4. Kokate, CK Purohit, AP. and Gokhale, SB. Pharmacognosy;
5.Ross,MF. And Brain,KR.An introduction to Phytopharmacy,Pitman Medical –Kent; 6. Deinvert,J. and BajajYPS.Applied and Fundamental Aspects of Plant Cell ,Tissue and Organ Culture,Berlin.

COURSE NO 706: PHARMACOGNOSY AND PHYTOCHEMISTRY II (PRACTICAL)

1.Identification of powdered crude drugs and their combinations with the help of organoleptic, microscopic and chemical tests;2.Determination of leaf constants such as stomatal index, stomatal number, vein islet number and palisade ratio; 3.Thin layer chromatographic studies of extracts from crude drugs.

Recommended Books:

1.Pharmacopoeia of India,1985;
2.Practical Pharmacognosy,3rd Edition, By Kokate,C.K.;
3.Practical Pharmacognosy by Lala,P.K.,Lina,Calcutta,198.

COURSE NO 707: GMP AND VALIDATIONS

Learning objectives:

1. To understand the standard specifications and procedures required in the manufacture of dosage forms
2. To understand the modern concepts of validation, quality assurance and statistical quality control

Units	Contents	Hrs
Unit-1:	CGMP: A detailed study of GMP as prescribed in Schedule M of Drugs and Cosmetics Act and Rules. Requirements regarding premises, sanitation, personnel, equipment and building, documentation and records and processes.	**10**
Unit-2:	Control of Production Procedures: Manufacturing Control – In – Process Quality Control for solids, liquids, semisolids and parenteral products – packaging control.	**08**
Unit-3:	Control of Finished Products: Tablets , Capsules, parenterals, semisolids, liquid orals	**06**
Unit-4:	Validation: Types and Protocols of Validations – A study of Process Validation. Validation of Equipments	**06**
Unit-5:	Cleaning Validation, Analytical Method Validation – Procedures and Examples.	**08**
Unit-6:	Quality Assurance: Principles and General Concepts – Duties and Responsibilities of Quality Assurance Departments in a modern Pharmaceutical Concern – Sources of Quality Variation, Control of Quality Variation (Raw Material Control (active materials, inactive materials), In- process items control	**08**
Unit-7:	Quality Assurance before Start – up (environmental and microbiological control and sanitation, Manufacturing working formula procedures, Raw materials, manufacturing equipment); Quality assurance at Start – up (Raw materials processing,	**07**

	compounding, Packaging Materials and Labels control, finished product control).	
Unit-8:	Concept of Statistical Quality Control – Quality Control Charts (control charts by variables, control charts by attributes), quality level and inherent variability – Sampling and Sampling Plans.	**07**

Recommended Books:

1. The Theory and Practice of Industrial Pharmacy by Leon Lachman, H.A. Liberman and Joseph L. Kanig, 3rd Edition, Lea & Febiger publishers, Philadelphia.
2. Quality Assurance of Pharmaceuticals Vol. I and Vol. II published by Pharma book syndicate.
3. Pharmaceutical Product Development by N.K. Jain, CBS Publishers & Distributors Pvt. Ltd. Tablets – Vol. I, II and III by Leon Lachman et al.

Reference Books:

1. Pharmaceutical Dosage Forms, Tablets – Vol. I, II and III edited by H.A. Lieberman and Leon Lachman, Marcel Dekker, Inc.
2. Modern Pharmaceutics by Banker.

COURSE NO 708: Professional Training

Training in Industrial, Hospital and Community Pharmacy

B.PHARM VIIIth SEMESTER

COURSE NO 801: PHARMACEUTICAL ANALYSIS –II (THEORY)

Learning objectives:

1. To emphasize the importance of quality in drugs & pharmaceuticals.
2. To establish the fundamental conventional methods of drug analysis used in laboratories.
3. To provide the knowledge regarding the principles of Instrumentation.
4. To give the basic principles of other analytical techniques used in Pharma Industries.
5. To teach applications of these analytical methods to drugs & pharmaceuticals

Units	Contents	Hrs
Unit-1:	Physicochemical aspects of analytical chemistry with special reference to pharmaceutical analysis. Chromatographic methods-1: Principles, theories, instrumentation and applications Involved in a) Column chromatography b) Paper chromatography c) Thin layer chromatography	08
Unit-2:	Chromatographic methods-I: Principles, theories, instrumentation and applications Involved in (i)HPTLC (ii) Ion-exchange and gel filtration techniques	08
Unit-3:	Chromatographic methods-II: Principles, theories, instrumentation and applications Involved in a) Gas chromatography (GC) b) High performance liquid chromatography (HPLC)	08
Unit-4:	Spectrophotometric analysis: A discussion of basic principles including interaction of matter with electro-magnetic radiation, absorption, emission, luminescence and scattering phenomena, units of measurement and definition of terms: a) absorptiometry: quantitative consideration of absorption phenomena including Beer and Lambert,s laws and their mathematical expression, deviations from the laws and methods used in absorption spectrophotometry (visible, UV and IR) including sources, monochromators, detectors, preparation of calibration curves and pharmaceutical applications. Sources of errors and their correction and validation of spectrophotometric methods.	08
Unit-5:	Basic principles, equipment and methods used and pharmaceutical applications of flame photometry, photofluorimetry, turbidimetry and nephlometry.	06

Unit-6:	Electrochemical Analysis: A discussion of basic principles involved in electrochemical analysis, electrochemical cells and half-cells, electrodes, electrode reactions and electrode potentials:a) Potentiometry: basic principles involved in measurement of EMF and pH , Nernest equation, typical equipment and their construction, factors influencing EMF of cell, portable, stationary and on-line equipment for pH measurement, applications.	08
Unit-7:	Potentiometric titrations including principles involved, methods for detection pf end point including dead stop mend point, applications in neutralization, redox and precipitation titrations, equipment used, exploration of titration curves obtained with acids and bases of different strength and mixture of acids. c) Conductometric titrations: basic principles, titrations, equipment and applications.	07
Unit-8:	Polarography: basic principles, titrations, equipment and applications in qualitative and quantitative analysis.e) amperometric titrations: basic principles, titrations, equipment and applications, Basic principles, definition of terms, equipment and their working and applications of – NMR and Mass spectrometry. Thermal methods of analysis and radioimmunoassay assay.	07

Reference books:

1. Pharmaceutical chemistrty by L.G. Chatten (Marcel Dekker)
2. A text book of pharmaceutical analysis by K.A. Connors (John Willey)
3. Pharmaceutical analysis- modern methods by J.W. Munson (Marcel Dekker)
4. Instrumental methods of analysis by Willard, Merritt, Dean and Settle (CBS publishers)
5. Text book of analytical chemistry by Y.Anjaneyalu, K.Chandra sekhar and Valli manickam.
6. Introduction to Instrumental analysis by Robert D.Braun Published by Pharma book syndicate.

COURSE NO 802: PHARMACEUTICAL ANALYSIS –II (PRACTICAL)

1. Separation of plant materials by column chromatography 2. Separation and identification of flavonoids/sulphonamides by paper chromatography 3. Separation and identification of sulphonamides by paper chromatography 4. Separation and identification of amino acids by TLC methods 5. Separation and identification of barbiturates by TLC methods 6. Determination of λ max,($KMnO_4$ and methylene blue solutions).7. Demonstration experiments in HPLC and GLC 8. Assay of sulphadiazine tablets by visible spectrophotometry 9. Assay of sulphadiazine tablets by UV spectrophotometry 10. Demonstration experiments in IR spectrophotometry injcluding interpretation of given spectra. 11. Fluorimetric estimation of quinine sulphate in formulations 12. Fluorimetric estimation of riboflavin in formulations 13. Flame photometric estimation of sodium and potassium ions 14. Potentiometric analysis a) Determination of pH of two solutions b)

Titration of strong acid against strong base c) Titration of strong base against weak acid d) Simultaneous determination of strong acid and weak acid in a mixture e) Potentiometric assay of any two formulations from I.P. 15. Conductometric titration of NaOH with HCl 16. Polarographic estimation of drug official in I.P. 17. Determination of concentration of sugar solution by polarimetry 18. Determination of critical micellar concentration (butyric acid in water using abbe refractometer.19. Demonstration experiments in detection of polymorphism and pseudo polymorphism in pharmaceuticals by DTA and DSC 20. Assay of an ointment and cream official in I.P. 21. Complete testing and assay of any two drugs as per I.P. monograph.

Reference books:

1. A text book of pharmaceutical analysis by K.A. Connors (John Willey).

COURSE NO 803: BIOPHARMACEUTICS AND PHARMACOKINETICS

Learning objectives:

1. The student will be able to understand the mechanism, factors influencing the absorption, distribution, metabolism and excretion of drugs (ADME)
2. With the understanding of the ADME pathways the student will be able to calculate the pharmacokinetic and pharmacodynamic parameters
3. The student will be able to design suitable dosage forms using the knowledge of physico-chemical, biological and other properties studied.

Units	Contents	Hrs
Unit-1:	**Biopharmaceutics**: Definition and introduction to biopharmaceutics, Fundamental principles of pharmacokinetics and pharmacodynamics, concepts of absorption, distribution, metabolism and elimination. Definitions and explanation of the terms connected with the study of biopharmaceutics. Basic pharmacokinetic models viz. compartment, catenary and mammillary models.	**06**
Unit-2:	**Physiological factors related to drug absorption**: Structure of cell membrane and its significance in drug absorption. Mechanisms of drug absorption, per oral routes of administration, anatomical and physiological considerations of the gastrointestinal tract, absorption of drugs from gastrointestinal tract and factors governing gastrointestinal drug absorption, first pass effect and its significance. Fick's first law of diffusion and *in vivo* sink condition	**08**
Unit-3:	**Biopharmaceutical considerations in dosage form design**: Rate limiting steps in drug absorption, introduction to BCS (biopharmaceutical classification system), physico-chemical factors of drug, pharmaceutical factors, formulation factors effecting drug absorption and bioavailability. Theories of dissolution and i*n vitro* dissolution testing, *in vitro* sink condition, compendial methods of dissolution testing of different dosage forms.	**08**
Unit-4:	**Drug distribution**: Physiological barriers for drug distribution, plasma protein binding of drugs, its significance and kinetics, factors influencing the drug distribution, apparent volume of distribution and its significance.	**07**
Unit-5:	**Metabolism and excretion of drugs**: Significance of biotransformation, factors influencing biotransformation, hepatic metabolism, microsomal and non microsomal metabolism, effects of enzyme induction and inhibition on biotransformation, phase I and phase II biotransformation reactions, renal and non-renal routes of drug excretion, concept of clearance, total body clearance, renal clearance, non-renal clearance, clearance ratio, factors effecting the clearance of drugs, glomerular filtration rate, tubular reabsorption.	**08**

Unit-6:	**Bioavailability and bioequivalence**: Definitions of different types of bioavailability and bioequivalence, objectives of bioavailability studies, methods for improving the bioavailability of drugs. Methods for assessing bioavailability, experimental design and evaluation of bioavailability studies, *in vitro* and *in vivo* correlation methods.	**08**
Unit-7:	**Pharmacokinetics**: Introduction to pharmacokinetics, their importance in bioavailability and clinical practice. Concepts, definition and explanation of terminologies used. Compartment models- concepts and their importance in the study of pharmacokinetics. One compartment open model - Determination of pharmacokinetic parameters from plasma and urine data after i.v. injection and oral administration. Percent absorbed time plot and absorption rates based on one compartment model. Non-compartmental analysis.	**10**
Unit-8:	**Non-Linear Pharmacokinetics, individual and optimization of drug dosage regimens**: Causes of non-linearity, detection of non-linearity, Michaeles Menton equation and calculation of Michaeles Menton constant and maximum metabolic rate. Basic concepts relating to individualization of dosage with reference to pediatric, geriatric, liver and renal impaired patients.	**10**

Recommended Books

1. Biopharmaceutics and Pharmacokinetics-A Treatise - D.M. Brahmakar, Sunil. B. Jaiswal, 2nd Edition, Vallabh Prakashan, 2012.
2. Biopharmaceutics and Pharmacokinetics, V. Venkateswarlu. 2nd Edition, Pharma Book Syndicate, 2010.
3. Biopharmaceutics and Clinical Pharmacokinetics, Milo Gibaldi. 4th Edition, Pharma Book Syndicate, 2005.
4. Applied Biopharmaceutics & Pharmacokinetics, Shargel and Andrew Yu, 6th Edition, Mc GrawHill Professional, 2012.

COURSE NO 804: BIOPHARMACEUTICS AND PHARMACOKINETICS PRACTICALS

1. Dissolution testing of conventional marketed tablet containing drugs like aspirin, paracetamol, theophylline
2. Dissolution testing of controlled/sustained release dosage forms containing drugs like theophylline, diclofenac sodium, aceclofenac sodium
3. Dissolution testing of enteric coated tablets like aspirin
4. Effect of particle size on dissolution rate of drugs using drugs like aspirin
5. Effect of surfactant on dissolution rate of drugs using drugs like nimesulide, sulfamethoxazole
6. Plasma protein binding studies of drug using egg albumin by dialysis sac method for drugs having plasma protein binding

7. Calculation of pharmacokinetic parameters using different pharmacokinetic approaches by using plasma, urinary and salivary data (Not less than 5 problems.
8. Calculations of bioavailability and bioequivalence using theoretical data
9. Writing the experimental protocol for bioavailability and bioequivalence studies for the given formulation

COURSE NO 805: CLINICAL PHARMACY & THERAPEUTICS

Learning objectives:

1. To understand the dosage calculations appropriate for the patient and be able to select the proper drug.
2. To understand the adverse drug reactions and drug interactions of various classes of drugs.
3. To understand the importance of rational prescribing of drugs and concept of essential drugs.
4. To impart the knowledge on the therapy of various disorders.

Units	Contents	Hrs
Unit-1:	General concept: Clinical pharmacokinetics, drug interactions, adverse drug reactions, parenteral nutrition.	**06**
Unit-2:	Pharmacoeconomics, Pharmacogenomics, Pharmacovigilance, Therapeutic drug monitoring, Neutraceuticals, essential drugs and rational drug usage.	**07**
Unit-3:	Age related drug therapy: concept of posology, drug therapy for neonates, pediatrics and geriatrics. Drugs used in pregnancy and lactation.	**07**
Unit-4:	Drug therapy for neurological and psychological disorders.	**06**
Unit-5:	Drug therapy in infections of respiratory system, urinary system, infective meningitis, TB, HIV, malaria and filaria.	**09**
Unit-6:	Drug therapy for thyroid and parathyroid disorders, diabetes mellitus, menstrual cycle disorders, menopause and male sexual dysfunction.	**08**
Unit-7:	Drug therapy for malignant disorders like leukemia, lymphoma and solid tumors.	**10**
Unit-8:	Drug therapy for rheumatic, eye and skin disorders.	**07**

COURSE NO 806: NOVEL DRUG DELIVERY SYSTEMS THEORY

Learning objectives:

1. To understand the concepts of controlled drug delivery and targeting
2. To understand the design of controlled and targeted drug delivery systems

Units	Contents	Hrs
Unit-1:	Introduction to novel drug delivery systems, Basic Concepts in sustained and controlled release, advantages and disadvantages of controlled release products. Factors influencing the design and performance of controlled release products.	**10**
Unit-2:	Targeting, passive and active, mechanisms and basic techniques used.	**6**
Unit-3:	Design, preparation and characterization of Oral Controlled Release products (Matrix Tablets, Coated Pellets, OROS, microcapsules, gastro retentive systems).	**10**
Unit-4:	Design, preparation and characterization of Parenteral controlled release products (Microspheres, Emulsions, suspensions).	**08**
Unit-5:	Design, preparation and characterization of Transdermal Therapeutic Systems (TTS) (Drug in adhesive type, matrix type, reservoir type, membrane matrix hybrid type, microreservoir type).	**8**
Unit-6:	Design, preparation and characterization of Implants and implantable devices, osmotically controlled drug delivery systems.	**08**
Unit-7:	Design, preparation and characterization of Liposomes, resealed erythrocytes.	**10**
Unit-8:	Design, preparation and characterization of Nanoparticles.	**08**

Recommended Text Books:

1. Lachman/Lieberman's The Theory and Practice of Industrial Pharmacy, Fourth Edition, Editors, Roop K khar, SP Vyas, Farhan J Ahmad and Gaurav K Jain, CBS Publishers and Distributors Pvt. Ltd.
2. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K. Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012
3. Modern Pharmaceutics by Banker.
4. Oral drug delivery technology by Aukunaru Jithan Published by Pharma Book Syndicate.