

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## SYLLABUS FOR FINAL YEAR B. PHARM.

### 401. PHARMACEUTICS – V (BIOPHARMACEUTICALS, PHARMOKINETICS AND DOSAGE FORM DESIGN)

3 hrs/ Week

#### THEORY:

Introduction to pharmacokinetics and biopharmaceuticals including History and their role in formulation development and therapeutics and clinical setting.

Pharmacokinetics :

- 2.1 Definition and scope, Significance of plasma drug concentration measurement
- 2.2 Compartment model
- 2.3 Pharmacokinetics of drug absorption zero order and first order absorption rate constant using wanger-nelson and Loo-Reigemana Model.
- 2.4 Volume of distribution coefficient.
- 2.5 Compartment kinetics – one compartment and two compartment models. Determination of pharmacokinetics parameters from plasma and urine after drug administration by intravascular and oral route.
- 2.6 Curve fitting (Method of residuals), regression procedures.
- 2.7 Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance.
- 2.8 Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.
- 2.9 Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Micheal Menten Equation. Detection of non-linearity (Saturation mechanism).
- 2.10 In-vitro, in-vivo correlation.
- 2.11 Numerical related to pharmacokinetics parameters using one compartment models.

Non-compartmental models:

Statistician moments application, bio-availability determination linear system pharmacokinetics, unit impulse response. Deconvolution. Application in bio-availability determination etc.

Biopharmaceuticals

- a Definition. Absorption, distribution, metabolism (biotransformation) and excretion (elimination) of drugs, physicochemical, biological and pharmaceutical factors altering biopharmaceuticals performance of drugs. Passages of drugs across biological barrier (passive diffusion active transport, facilitated diffusion and pinocytosis). Factors influencing absorption : physicochemical and pharmaceutical drug distribution in the body, plasma protein binding.
- b Bio-availability and equivalence, federal requirements , methods of determination of bio-availability using blood level and urinary excretion data. Design and evaluation of bioavailability assessment.

## **Clinical pharmacokinetics**

- 5.1 Definition and scope.
- 5.2 Dosage adjustment in patient renal and hepatic failure.
- 5.3 Dosage regimen adjustment for ref.
- 5.4 Pharmacokinetics drugs interaction significance in combination therapy.

## **Bioavailability and bioequivalence**

- 2.1 Measures of bioavailability,  $C_{max}$ ,  $T_{max}$ , AUC
- 2.2 Design of single dose bioequivalence statistics, study designs, crossover designs, study protocol, log transformation of pharmacokinetics data, sequence effect, outliers.
- 2.3 Overview of regulatory requirement of bio-equivalence study.

## **Permutation studies:**

- 7.1 Study of physical properties of drug like physical form, particle size, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation stability and bioavailability.
- 7.2 Study of chemical properties of drug like hydrolysis, oxidation, reduction, racemization, polymerization etc. and their influence on formulation and stability of products.
- 7.3 Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulations.

Design development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions. Prospective retrospective validation, organizing of validation, validation for dry heat, moist heat, filtration ethylene oxide radiation sterilization. Validation of parenterals solid dosage forms validation of raw material.

Definition and control of process variables guidelines, validation protocols.

Stabilization and stability testing protocol for various pharmaceutical products ICH guidelines for stability testing.

Performance evaluation methods:

- 1.1 In vitro dissolution studies for solid dosage forms, methods, and interpretations of dissolution data.
- 1.2 Bio-availability studies and bioavailability testing protocols and procedures.

Design development production and evaluation of controlled released formulations.

Introduction design of control release drug delivery systems (Biopharmaceutic pharmacokinetics, pharmacodynamic, characteristics of drug) pharmacokinetics principles in design, development of CDDS, drug release models, oral parenteral ophthalmic, transdermal CDDS. Drug targeting. Evaluation of CDDS, bioavailability testing.

## **PRACTICALS:**

3 hrs / week

- 1 Experiments to illustrate absorption of drug in various models.
- 2 Experiments to illustrate protein binding of drugs.  $K$  and  $N$  values of binding process.
- 3 Determination of plasma half life, elimination constant using plasma drug profile.
- 4 Determination of pharmacokinetics of single compartmental analysis.
- 5 Experiments to illustrate curve fitting, area under the blood level curves, binding bioequivalence determination.

- 6 Preformulation studies including drug excipients compatibility studies, effect of stabilizers, preservatives in dosage form design.
- 7 Experiment demonstrating improvement in bioavailability through prodrug concept.
- 8 Stability evaluation of various dosage forms and their expiration dating.
- 9 Dissolution testing and date evaluation for oral solid dosage forms.
- 10 Evaluation of bioequivalence of some marketed products.
- 11 In-vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves.
- 12 Design, development and evaluation of controlled release formulations.

**BOOKS RECOMMENDED:**

- 1 Physical pharmacy by Martin
- 2 Theory and Practice of Industrial Pharmacy by Lachman.
- 3 Remington pharmaceutical formulation by Mithal.
- 4 Textbook of pharmaceutical formulation by Mithal.
- 5 Pharmaceutical dosage forms: Tablets by Lachman and others.
- 6 Pharmaceutical dosage forms: Dispersed systems by Lieberman and others.
- 7 Pharmaceutical dosage forms: Parenteral medication by Lieberman and others.
- 8 Microencapsulation by Benita.
- 9 Pharmaceutical dosage forms and drug delivery systems by Ansol and others.
- 10 Controlled and novel drug delivery system by N. K. Jain.
- 11 Drug stability by Carstensen.
- 12 Modern pharmaceuticals by Banker and Rhodes.
- 13 Biopharmaceutics and Clinical pharmacokinetics by Notari.
- 14 Applied biopharmaceutics and pharmacokinetics by Shergel and Yu.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## SYLLABUS FOR FINAL YEAR B. PHARM.

### 402. PHARMACEUTICS-VI (PHARMACEUTICAL TECHNOLOGY AND INDUSTRIAL PHARMACY)

#### THEORY:

1. Liquid dosage Forms:  
Introduction, types of additives used, vehicles, stabilizers, preservatives, emulsifying agents, solubilizers, colors, manufacturing, packing and evaluation of ideal suspensions and emulsions officials in phamacopoeia.
2. Semisolid dosage forms:  
Definition, types, mechanisms of drug penetration through skin, factors influencing penetration, \_\_\_\_solid bases and their selection. General formulation of semisolids, clear gels, manufacturing procedure, evaluation and packing.
3. Tablets:
  - 3.1 Introduction to types of tablets, formulation of different types of tablets: excipients, granulation techniques, machinery for large scale granulation techniques, physics of tablet making, compression machinery in process controls, processing problems evaluation parameters and equipments.
  - 3.2 Coating of tablets: objective, types of coating, film forming materials, formulation of coating solution, equipment for coating, coating process, evaluation of coated tablets, coating defects specialized coating process.
4. Capsules:  
Advantages and disadvantages of capsule design form, size of capsules, material for production of hard gelatin capsules, formulation of hard gelatin capsules, method of capsule filling, soft gelatin capsule, shell and capsule content, importance of base absorption and minimum/gm, factors in soft capsule, quality control, stability testing and storage of capsule design form.
5. Microencapsulation:  
Introduction techniques of microencapsulation, characterization and applications.
6. Parental products:
  - 1.1 Preformulation factors, routes of administration, vehicles – aqueous, non-aqueous, pyrogenicity, pyrogen testing isotonicity and methods of its adjustment, modern methods for preparing WFI.
  - 1.2 Formulation details, containers and closures – types characteristics and selection
  - 1.3 Prefilling treatment washing of containers and closures, and introduction to glass plastic and rubber as materials of containers and closures of parental products, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion, fluids, ophthalmic preparations, lyophilization and preparation of sterile powders, equipments for large scale manufacturing and evaluation of parental products.
  - 1.4 Aseptic techniques, sources contamination and method of prevention, design of aseptic area, laminar flow benches, services and maintenance.
7. Pharmaceutical aerosols:  
Defination, propellants, general formulation, containers, selection of components, manufacturing and packaging methods, pharmaceutical applications, evaluation of aerosols.

8.           Cosmetic technology:  
Fundamentals of cosmetic science, structure and functions of skin and hair, formulation, preparation and packaging of cosmetic for skin-sunscreen, moisturizers, cold cream and vanishing cream. Hair shampoo and conditioners, dentifrice-powders, gels, pest and manicure preparations like nail polish, lipsticks, eye lashes, brief introduction on baby care products, shaving creams.
9.           Packaging of pharmaceutical products:  
Packaging components, types, specifications, stability, aspects of packaging, packaging equipments, factor influencing choice of containers, legal and other official requirements for containers, package testing.
10.          Labeling of Pharmaceutical: FDA requirements:  
Good manufacturing practice for pharmaceuticals:  
Introduction, WHO guidelines, practice of GMP, = Procedures (SOP's), building, equipment, personnel, components documentation, containers, labeling, laboratory control, distribution record, recovery and reprocessing.

### **PRACTICALS:**

**3hrs/week**

1.           Preparation evaluation and packaging of liquid orals like solutions, suspensions and emulsions, \_\_\_\_\_, suppositories, aerosols, eye drops, eye ointment, etc.
2.           Preparation of pharmacopeial extracts and galenical products utilisting various methods of \_\_\_\_\_
3.           Formulation of various types of cosmetics for skin, hair, dentifrice and manicure preparation, experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical product like powders, capsules, tablets, parenterals, microencapsules, evalution of material used in pharmaceutical packaging.

### **BOOKS RECOMMENDED**

1. Theory and practice of industrial pharmacy by Lachman.
2. Remington's pharmaceutical sciences.
3. Textbook of pharmaceutical formulation by Mithal.
4. Pharmaceutical dosage forms: tablets by Lachman and others.
5. Pharmaceutical dosage forms: disperes systems by Lieberman and others.
6. Pharmaceutical dosage forms: parentral medication by Lieberman and others.
7. Microencapsulation by Benita.
8. Pharmaceutical dosage forms and drug delivery systems by Ansel and others.
9. GMP for Pharmaceuticals by Willig ad Stroker.
10. Cosmetics and toiletries industry by William and Schmitt.
11. Cosmetics: formulation, manufacture and quality control by P. P. Sharma.
12. Cosmetics by Poucher.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## SYLLABUS FOR FINAL YEAR B. PHARM.

### 403 MEDICINAL CHEMISTRY-II

#### THEORY

3Hrs/Week

1. Drug metabolism and concept of prodrug.
2. Synthetic procedures of selected drugs, mode of action, uses structure activity, relationship including physicochemical aspects of the following classes of drugs should be covered [Biochemical approaches in drug designing wherever, applicable should be discussed]

#### 2.1 Drug acting on the Central Nervous System:

General anaesthetics, local anaesthetics, hypnotics and sedatives, opioid analgesics, antitussives. Anticonvulsants, antiparkinsonian drugs, CNS, stimulants, psychopharmacological agents [neuroleptics, antidepressants, anxiolytics], Non-steroidal antiinflammatory drugs (NSAIDs)

SAR of local anaesthetics, benzodiazepines, phenothiazines.

Synthesis of procaine, lignocaine, diazepam, nitrozapam, phenobarbital, hexobarbital, pethidine, methadone, theophylline, nikethamide, chlorpromazine, amitriptyline, meprobamate, paracetamol, aspirin, diclofenac, ibuprofen, indomethacin, phenylbutazone, barbituric acid, benzocaine, bupivacaine, caffeine, carbamazepine, chlordiazepoxide, ethosuximide, fluphenazine, haloperidol, allopurinol, imipramine, pentobarbital, phenytoin, probenecid, prochlorperazine, reserpine, sodium pantothenate, tetracaine, valproate, etc.

#### 2.2 Drugs acting on cardiovascular system : Cardio tonics, antihypertensive agents, antianginal and vasodilators, lipid lowering agents (anti hyperlipidemic agents), pressure drugs (antihypertensive agents), miscellaneous (antiplatelets, thrombolytic drugs, \*\*\*\*\*).

SAR of cardiotonics including synthetic drugs.

Synthesis of clonidine, nifedipine, nicorandil, propranolol, sotalol, procainamide, atenolol, diltiazem, tolvaptan, clofibrate, hydralazine, metoprolol, guanethidine, warfarin, nifedipine, theophylline, captopril, isosorbide dinitrate, metoprolol, oxprolinal, prazosin.

#### 2.3 Steroids and related drugs : Steroidal nomenclature and stereochemistry. Androgens and anabolic agents \*\*\*\*gens and progestational agents, adrenocorticoids. SAR of adrenal cortex hormones.

#### 2.4 Diuretics

SAR of chlorthalidone \*\*\*\*\*ketones.

Synthesis of furosemide, chlorthalidone, hydrochlorothiazide and acetazolamide, chlorthalidone, d-mannitol, ethacrynic acid, triamterene, furosemide.

#### 2.5 Amino acids, proteins and peptide hormones :

1. Thyroid and antithyroid drugs

2. Insulin and oral hypoglycemic agents. Synthesis of carbinazole.
  3. peptidommetics and nucleotidemimetics.
- 2.6 Vitamins: Classification, general chemistry and structural formula of vitamins included in I.P. Detailed chemistry if Vit. – A, Vit-D, Vit-B<sub>1</sub>, Vit-B<sub>2</sub> and Vit-C.
- 2.7 Pharmaceutical aids: solvents and vehicles, preservatives and antioxidams, coloring agents, flavouring agents, sweetening agents, acidifying agents etc.

### **PRACTICALS**

**3 hrs./ Week**

- 1 Experiments designed on drug metabolism
  - a Preparation of s9 and microsomes from tissue homogenates and standardization of proteins.
  - b Effect of Phenobarbital pretreatment on microsomal cytochrome P-450, cytochrome b5 and NADPH cytochrome C-reductase and comparison of microsomes from control.
  - C Determination of microsomal azo and nitroreductase activities.

Submission of a pilot project along with the economics of one drug.  
Synthesis of selected drug.

Establishing the pharmacopeal standards and spectral studies.

### **BOOKS RECOMMENDED :**

- 1 Medical Chemistry by Burger.
- 2 Textbook of Org., Medicinal and Pharma. Chemistry by Wilson & Gisvold
- 3 Principle of Medicinal Chemistry by Foye, Williams & Lemke.
- 4 A Handbook of Organic Analysis by Clarke.
- 5 A Textbook of Practical Organic Chemistry by Vogel
- 6 Quantitative Organic analysis by Cheronis.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## SYLLABUS FOR FINAL YEAR B. PHARM.

### 404. PHARMACEUTICAL ANALYSIS –II (INSTRUMENTAL AND QUALITY ASSURANCE)

#### THEORY

3Hrs/Week

1. Quality Assurance: GLP, ISO 9000, TWM, Quality review and quality documentation and ICH
2. Regulatory control, regulatory drug analysis and interpretation of analytical data.
3. Validation quality of equipment, validation of equipment and validation of analytical instruments.
4. Chromatography : Principles and techniques involving separation of drug from excipients. The following technique: TLC, HPLC, GLC, HPTLC, paper chromatography and column chromatography.
5. The theoretical aspects, basic instrumentation, elements of interpretation of data/spectra and application of analytical technique be discussed on potentiometric titrations (including Karl Fisher titration), conductometric titrations polarography, amperometric titration, colorimetric titrations, polarometry, UV and visible spectrophotometry, infrared spectrophotometry, FTIR brief introduction to nuclear magnetic resonance spectroscopy, <sup>13</sup>CNMR, FTNMR, brief introduction to mass spectrometry, flame photometry, emission spectroscopy, atomic absorption sep\*\*\*\*\*, flurometry and thermal analysis including DSA and DIA. Radio immuno assays.

#### PRACTICALS

3 HRS./ WEEK

- 1 Quantitative estimation of at least 5 formulations containing single drug or more than one drug using instrumental techniques.
- 2 Estimation of Na and K and Ca ions using flame photometry.
- 3 IR determination of samples with different functional groups (-COOH, -COOR, -CONHR, -NH<sub>2</sub>, -OH, etc.)
- 4 Workshop to interpret the structure of simple organic compounds using UV IR NMR and MS.
- 5 Exercises involving potentiometry, conductivity, polarography, fluorimetry, and polarometry.

#### BOOKS RECOMMENDED:

- 1 Principles of instrumental analysis by Skoog, Holler, Nieman, 5<sup>th</sup> Ed., Saunders college publishing.
- 2 A textbook of pharmaceutical analysis by Kenneth A. Connors, 3<sup>rd</sup> Ed. John Wiley & Sons
- 3 Instrumental methods of chemical analysis by Galin W. Ewing 5<sup>th</sup> Ed. McGraw-Hill International Edition.
- 4 Principles of Instrumental analysis by Skoog I. Eary, 4<sup>th</sup> Ed. Saunders College Publishing.
- 5 Instrumental Methods of Analysis by Willard, Merrit Dean, Settle CBS Publishers 7<sup>th</sup> Ed.
- 6 Spect\*\*\*\*\* of organic compounds by Silverstein, bassler, morril, 5<sup>th</sup> Ed. John Wiley & Sons inc.
- 7 Understanding ISO 9000 and implementing the basics to quality by D.H. Stamtis Marcel Dekker Inc.

- 8 Guidelien for good laboratory quality auditing by Donald C. Singer, Ronald P. Upton, Marcel Dekker Inc.
- 9 Good Manufacturing Practices for pharmaceuticals: Aplan for total quality control by Sidney H. Willing, james R. Stoker, Marcel Dekker inc.
- 10 O.P.P. L. Manual
- 11 Good Laboratory Practice Regualtions ed by Sandy Weinberg Marcel Dekker inc.
- 12 Pharmaceutical Analysis : Modern Methods by James W. Munson, Marcel Dekker inc.
- 13 Practical Pharmaceutical Chemistry – I & II by A. II Backett and J.B. Stanlake 4<sup>th</sup> Ed. CBS publishers.
- 14 Indian, British and United State Pharmacopoeia.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## SYLLABUS FOR FINAL YEAR B. PHARM.

### 405. PHARMACOLOGY III (PHARMACOLOGY AND DRUG BIO EVALUATION)

#### THEORY

3 hrs/ week

- 1 Bioassay of drugs and biological standardization :  
Importance, principles and methods of bioassay, pyrogen testing, discovery and development of new drugs, bioassay methods of important drugs.
- 2 Pharmacology of central nervous system (CNS) :
  - a) Neurohumoral transmission in the CNS
  - b) General anaesthetics
  - c) Alcohols and dislirma
  - d) Sedatives – hypnotics, anti anxiety agents and centrally acting muscle relaxants.
  - e) Psychopharmacological agents : antipsychotics, antidepressants, antimaniacs and hallucinogens.
  - f) Antiepileptics drugs
  - g) Anti parkinsonian drugs
  - h) Analgesic, antipyretics, anti-inflammatory and antitussive drugs
  - i) Narcotic analgesics and antagonists.
  - j) CNS stimulants
  - k) Drug addiction and drug abuse
- 3 Pharmacology of cardiovascular system :
  - a) Digitalis and cardiac glycosides
  - b) Antihypertensive drugs
  - c) Antianginal and vasodilator drugs
  - d) Anti arrhythmic drugs
  - e) Antihyperlipidemic drugs
  - f) Drugs used in the therapy of shock.
- 4 Drugs acting on the Hemopoietic system
  - a) Haematinics
  - b) Anticoagulants vitamin K and hemostatic agents
  - c) Fibrinolytic and anti-plated drugs
  - d) Blood and plasma volume expanders
- 5 Drugs acting on the urinary system
  - a) Fluid and electrolyte balance
  - b) Diuretics
- 6 Drugs acting on the Respiratory system
  - a) Anti asthmatic drugs including bronchodilators
  - b) Antitussive and expectorants
  - c) Respiratory stimulants
- 7 Drugs acting on the gastrointestinal tract
  - a) antacids, antisecretory and anti ulcer drugs
  - b) ----- drugs
  - c) Appetite stimulants and suppressants

- d) Emotios and anti emotics
  - e) In miscellaneous, carminatives, demulcents, protectives, muscolytics, adsorbatns, astringents, diagestante and enzymes.
- 8 Pharmacology of endocrine system
- a) Hypothalamic and pituitary horomones
  - b) Thyroid hormones and antithyroid drugs, parathoromone, cactironin and vitamin D
  - c) Insulin, oral hypoglycemic agents and glucagons
  - d) ACTH and coricosteroids
  - e) Androgens and anabolic steroids
  - f) Androgens and anabolic steroids
  - g) Drugs acting on the uterus
  - h) Esrogen, progesterone and oral contraceptives
- 9
- (a) Adverse reaction to drugs : incidence, classification, surveillance, methods of adverse reaction to drugs and its management.
  - (b) Pharmacologentetics : Pharmokinetics and pharmodynamics aspects of pharmaogenetics.
  - (c) Drug interactions : incidence pharmokinetics and pharmodynamic drug interactions.
- 10 Recent advances :
- Brief overview of Gene therapy, molecular pharmacology, nitrous oxide endotheellins immunopharmacology.

## **PRACTICALS**

**3 hrs / week**

- 1 Experiments on isolated preparations
- a) To calculate the  $PA_2$  value of atropine using acetylcholine as an against on rate fleum preparation.
  - b) To calculate the  $PA_2$  value of mepyramine or chlorpheniramine using histamine as against on guineping ileum.
  - c) To find out the strength of given sample of against e.g. acetylcholine, histamine, 5-HT, oxtrocin etc. using suitable isolated muscle, preparation by three point assay, four point assay, graphical methods, matching method etc. To study the mi-secretary and anti ulcer activity using pylorus lighted rats. To demonstrate the effects of certain clinical useful drugs on human volunteers like arthistaminies. Anti anxiety and sedative drugs beta blockers etc.
- Experiments on central nervous system
- Recording spontancous motor activity, stercotype analgesia, anticonvulsant activity, anti-inflammatory activity and muscle relaxant activity of drugs using simple experiments.

## **BOOKS RECOMMENDED :**

- 1 Pharmacological basis of therapeutics by Goodman and Gillman
- 2 Medical pharmacology by Goth
- 3 Pharmacology by Guddam
- 4 Pharmacology and Pharmacothrapeutics by Satoskar and Bhandarkar
- 5 Essentials of pharmacotherapetucis by F.S.K. Barar
- 6 Lewis Pharmacology by Crossland
- 7 Textbooks of Pharmacology by Bowman and Rand

- 8 Essential of Medical Pharmacology by K.D. Tripathi
- 9 Pharmacology by Rand and Dale
- 10 Elements of Pharmacology by Dr. Derasari & Dr. Gandhi
- 11 Drug interaction by Hansten
- 12 Introduction to general toxicology by aries simonsis & Offermeier
- 13 Toxicology: the basic science of poisons by casorett & doull
- 14 Clinical Pharmacology by Lawrence
- 15 Principles of drug action by Goldstein Aronow & Kalaman
- 16 Drug Treatment by Avercy
- 17 Fundamentals of experimental Pharmacology by M.N. Ghosh
- 18 Handbook of experimental Pharmacology by S. K. Kulkarni
- 19 Pharmacological experiments on isolated preparation by perry
- 20 Practical in Pharmacology by Dr. Goyal.

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### 406 PHARMACOLOGY III

#### THEORY

3 hrs/ week

General technique of biosynthesis studies and basic metabolite pathways. An introduction to biogenesis of secondary metabolites of pharmaceutical importance from following categories.

- 1 Terpenoids – monoterpene, sesquiterpenes, diterpenes, and polyterpenoids.
- 2 Carotenoids: beta-carotenoids, alpha-carotenes, xanthophylls of medicinal importance.
- 3 Steroids : Hecogenin, diosgenin and sarsapogenin.
- 4 Alkaloids: Belladonna, cinchona, Rauwolfia, opium, Ephedra, Ergot and vicia alkaloids
- 5 Iridoids
- 6 World wide trade in medicinal plants and derived products with special reference to digoxin (digitalis), taxol (taxus sp.) digitalis, tropane, alkaloid, containing plants, papain cinchona, ipecac, liquorice, ginseng, aloe vera, valerian, rauwolfia, and plants containing laxatives.
- 7 A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phytoconstituents of poppy, ergot, cinchona, ipecaco, tropane alkaloids, vinca, aloes, senna, ispaghula, digitalis, discorea, and solanum khasianum.
- 8 Utilisation of aromatic plants and derived products with special reference to menthol, citral, sandalwood oils, clove oil, geranium and eucalyptus oil.
- 9 Tissue culture: types of plant tissue culture and growth profile, modification, tissue culture lab and experimental\*\* of culture media. Applications of plant tissue culture in pharmacognosy.
- 10 Introduction to ayurvedic system of medicine – prakriti (Kaf, vayu and pitta), formulations – arka, asava and arista, avalambas, bhujangas, chandas, ghritas, gutika, Kvaths, Lepams, malams, pakas, satvas, suras, tailas.

- 11 Ashwagndharishtha, manishthadikwatha, kanasava, kutajarishtha, punarnavasava, maharasnadikwatha, amrutarishtha, ashokarishtha, mahasudarshan churna, shitopaladi churna, hingvashtak churna.
- 12 Marine pharmacolgnosy : novel medicines from marine source.
- 13 Neutraceuticals : Herbs as health tood, (brief overview)

### **PRACTICALS**

**3 hrs / week**

- 1 Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.
- 2 Exercise on paper and thin layer chromatographic evaluations of herbal drug constituents.
- 3 Isolation of some selected phyroconstituensts studies in theory.
- 4 Extraction of volatile oil and their chromatographic profiles.
- 5 Some experiments in plant tissue culture.

### **BOOKS RECOMMENDED**

- 1 Pharmacognosy by G.E. Trease and W.C. evans
- 2 Textbook of pharmacognosy by T.E. Wallis
- 3 Pharmacognosy by V.E. Tylor, L.R. Brady and J.E. Robbers
- 4 The wealth of India (raw material and industrial product)
- 5 Compendiaum of Indian medicinal plants vol I to IV
- 6 Cultivation and utilization of aromatic plants by atal and Kappor
- 7 Cultivation and utilization of medicinal plants by atal and Kappor
- 8 Textbook of pharmacognosy by steinigner and hansel
- 9 Textbook of pharmacognosy by ramsted
- 10 Powdered vegetable drugs by B.P. Leckson and D.W. Sneedan
- 11 Biosynthetic product for cancer chemotherapy by george patit vol I to III, plenum press NY.
- 12 Natural products as Medicinal agents ed. J.L. Beal and reinhard Hippocrated Verlag Press NY.
- 13 Medicinal plants Glyoosides by Sim. Totonto
- 14 Medicinal plants Alkloids by Sim Tononto
- 15 Indian medicinal plants by Kirtikar and Basu
- 16 Phytochemische Prakrukum by Wanger
- 17 Natural product by Ikan R, Israel Uni. Press Jarusalem, 1969.
- 18 Experimental pharmacognosy by Tylar, V.E. and Schwarting A.E. Borgess Press publication.
- 19 Isolierum Und Kennenzeikhnung by Stahl E. and Schild W.
- 20 Ayurvedic pharmocopea.