SEMESTER - V

PHAR-351
PHARMACEUTICAL CHEMISTRY – IV  
(BIOCHEMISTRY)

Unit-I :
1. **Enzymes**: Nomenclature, enzymes-kinetics and mechanism of action, mechanism of inhibition of enzymes and isoenzymes in chemical diagnosis.  
2. **Co-enzymes**: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance. [08]

Unit-II
3. **Carbohydrate metabolism**: Glycolysis, Gluconeogenesis and Glycogenolysis. Metabolism of galactose and galactosemia. Role of sugar nucleotides in biosynthesis and pentose phosphate pathway.  
4. The citric acid cycle, significance, reactions and energetics of the cycle. [08]

Unit-III
5. **Lipid metabolism**: Oxidation of fatty acids-oxidation & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids., regulation of lipid metabolism, essential fatty acids.  
6. **Biological Oxidation**: The respiratory chain, its role in energy capture & control, Energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation. [08]

Unit-IV
7. Biosynthesis of amino acids, catabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine., formation of deoxyribonucleotides.  
8. Biosynthesis of RNA, DNA replication, carcinogenesis & DNA repair mechanism. [08]

Unit-V
10. Regulation of gene expression. (Prokaryote and Eukaryote) [08]

**PHAR- 351P**

PHARMACEUTICAL CHEMISTRY-IV  
(BIOCHEMISTRY)

PRACTICAL
1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.  
2. Titration curve for amino acids.  
4. The separation of lipids by TLC.  
6. The determination of glucose by means of the enzyme glucose oxidase.  
7. Enzymatic hydrolysis of glycogen by α & β amylase.  
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

BOOKS RECOMMENDED :
Stryer L., Biochemistry, WH, Freeman & Company, San Francisco.

PH-352

PHARMACEUTICS – V  
(PHARMACEUTICAL TECHNOLOGY -I)

Unit-I : Preformulation studies :
   a) Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. [08]

Unit-II : Liquid Dosage Forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, Manufacturing packaging & evaluation of clear liquids, suspensions and emulsions. [08]

Unit-III : Semisolid Dosage Forms : Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, General formulation of semisolids, clear gels & manufacturing procedure, evaluation and packaging. [08]

Unit-IV : Suppositories : Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

Pharmaceutical Aerosols: Definition, Propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. [08]

Unit-V : Cosmetology and cosmetic Preparations : Structure of skin, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, deodorant, face powder. Hair structure, Shampoos, Conditioner, Shaving and after shaving products, Dentrifice & Mouthwash, Lipstick, Nail lacquer. [08]

PHAR-352P

PHARMACEUTICS-V  
(PHARMACEUTICAL TECHNOLOGY-I)

PRACTICAL
1. Preparation of cold cream, vanishing cream, cleansing lotion and creams. Moisturizing creams, Skin tonics, Hair creams, Hair Conditioners, Shampoos, Shaving creams and sticks. Tooth powder, Tooth pastes, After shave lotion and other cosmetic preparations.
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.

SUGGESTED PRACTICALS
1. Preparation, Evaluation, and packing of (10 preparations =5 labs)
   1- Liquid Orals
      a) Solutions : Strong Sodium salicylates oral solution BP
                     : Chloral hydrate BP
      b) Suspensions : Magnesium sulphate oral suspension BP
                      : Milk of magnesia IP
                      : Aluminium hydroxide gel IP
      c) Emulsions : Liquid paraffin oral emulsion BP
II - Semi Solid

d) Ointments: Salicylic acid ointment BP
   : Whitfield ointment BP
   : Compound benzoic acid ointment

III - Suppositories
e) Suppositories: Glycerin suppositories BP
   : Lactic acid suppositories BP

2. Preparation of cosmetic preparations (30 preparation = 10 labs)

   1) Cold cream 16) Cream shampoo
   2) Vanishing cream 17) Clear liquid shampoo
   3) Cleansing cream 18) Shaving cream
   4) All purpose cream 19) Brushless shaving cream
   5) Protective cream 20) After shave lotion
   6) Foundation lotion 21) Hair fixer gel
   7) Sunscreen lotion 22) Tooth powder
   8) Face powder 23) Tooth paste
   9) Body powder 24) Mouth wash
  10) Hand cream 25) Hair conditioner
  11) Face pack 26) Anti dandruff shampoo
  12) Deodorant 27) Depilatory cream
  13) Antiperspirant 28) Bleach cream
  14) Shampoo-powder 29) Hair setting lotion
  15) Oily shampoo 30) Tooth gel

BOOKS RECOMMENDED

PHAR-353

PHARMACOLOGY – I

Unit-I : 1. General Pharmacology – Introduction to pharmacology, sources of drugs, dosage forms & routes of administration, mechanism of action, concept of receptors, combined effect of drugs, factors modifying drug action, tolerance & dependence, absorption, distribution. [07]

Unit-II : Metabolism & excretion of drugs, principles of Clinical Pharmacokinetics. Adverse drug reactions & treatment of poisoning. ADME drug interactions, Bioassay of drugs & Biological standardization. Discovery & development of new drugs. [07]

Unit-III : Pharmacology of ANS-
   a) Neurohumoral transmission (autonomic & somatic)
   b) Parasympathomimetics, Parasympatholytics, Sympathomimetics, adrenergic receptor & neuron blocking agents, ganglionic stimulants & blocking agents. [08]
Unit-IV : Pharmacology of CNS


Unit-V : Drugs acting on PNS

Neuromuscular blockers, Local anaesthetics.

PHAR-353P

PHARMACOLOGY-I

PRACTICAL

1. Use of computer simulated CDs or Video cassetes for pharmacology practical whenever possible.


3. Study of different routes of administration of drugs in mice/rats. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice.


BOOKS RECOMMENDED :

7. Laurence, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.

PHAR-354

PHARMACEUTICAL CHEMISTRY-V
(MEDICINAL CHEMISTRY-I)

Unit-I : Basic Principles of Medicinal Chemistry: Physicochemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action. Drug-receptor interaction including transduction mechanism, concept of prodrug.

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

Unit-II : Drugs acting at Synaptic and neuro-effector junction sites:

Cholinergic, Anticholinergic & Anticholinesterases-Neostigmine, Physostigmine, Methacholine, Pilocarpine, Atropine.


Unit-III: Drugs acting on the Central Nervous System:

General Anaesthetics-Thiopental, Ketamine, Methohexital.

Local Anaesthetics-Lignocaine, Benzocaine.
Hypnotics and Sedatives: Phenobarbitone, Pentobarbitone.
Opioid Analgesics: Pethidine, Methadone, Pentazocine.

Unit-IV: Antitussives: Caramiphen, Dextromethorphen.
Anticonvulsants: Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.
Antiparkinsonism drugs: Carbidopa, Levodopa.
CNS Stimulants: Caffeine, Nikethamide.

Unit-V: Psychopharmacological Agents
Neuroleptics: Imipramine, Amitriptyline.
Antidepressants: Meprobamate, Chlordiazepoxide, Diazepam.
Antispasmodic and Antiulcer drugs: Dicyclomine, Ranitidine, Omeprazole.
Neuromuscular Blocking Agents: Gallamine Triethiodide, Mephenesin, Pancuronium.

PHARMACEUTICAL CHEMISTRY-V
(MEDICINAL CHEMISTRY-I)

PRACTICAL
1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.

SUGGESTED PRACTICALS
1. Synthesis of Methyl salicylate.
2. To establish pharmacopoeial standards of Methyl salicylate.
4. To establish pharmacopoeial standards of Paracetamol.
5. To synthesize Benzocaine.
6. To establish pharmacopoeial standards of Benzocaine.
7. Synthesis of Phenytoin.
8. To establish pharmacopoeial standards of Phenytoin.
10. To establish pharmacopoeial standards of Hydantoin.
12. To establish pharmacopoeial standards of Barbituric acid.

BOOKS RECOMMENDED:
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
   Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
7. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan,
   Delhi.
   York, Oxford.

PHARMACEUTICS – VI
(Physical Pharmacy)
Unit-I: (A) Matter, properties of Matter:
States of matter, change in the state of matter, latent heats and vapor pressure, sublimation critical point, Eutectic mixtures, gases, relative humidity, liquid complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism.

(B) Kinetics and Drug Stability:

(C) Buffers:
Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Unit-II: Micromeritics and Powder Rheology:
Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Unit-III: Surface and Interfacial Phenomenon:
Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties of interface.

Unit-IV: Viscosity and Rheology:
Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotrophy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.

Complexation:
Classification of complexes, methods of preparation and analysis, applications.

Unit-V: Dispersion Systems:
Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in pharmacy; Suspensions and Emulsions; Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.

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PHARMACEUTICS – VI
(PHYSICAL PHARMACY)

PRACTICAL
1. Determination of particle size, Particle size distribution and surface area using various methods of particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Determination of surface/interfacial tension, HLB value and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different Viscometers.
5. Studies of different types of colloids and their properties.
6. Preparation of various types of suspensions and determination of their sedimentation parameters.
7. Preparation and stability studies of emulsions.
8. Studies of different types of complexes and determination of their stability constants.
9. Determination of half-life, rate constant and order of reaction.
10. To study the influence of various factors on the rate of reaction.
11. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Experiments involving tonicity adjustments.

BOOKS RECOMMENDED:

SEMESTER –VI

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PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY - II)

Unit-I

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

Unit- II
Cardiovascular Agents – Antianginal & vasodilators, antiarrhythmics, antihypertensives, anticoagulants, antihyperlipidemics & cardiotonics – Nifedipine, Procainamide, Propranolol, Methyldopa, Captopril, Clofibrate, Warfarin, Phenidione.

[08]

Unit-III Autocoids :

Antihistaminics :

i) H1 antagonists – Diphenhydramine, Promethazine, Cyproheptadine, Cetrizine.

ii) H2 antagonists – Ranitidine, Famotidine.

Antineoplastics : Chlorambucil, 5- Fluorouracil, Methotrexate.

[08]

Unit-IV : Analgesics and Antipyretics – Aspirin, Mefeanamic Acid, Ibuprofen, Diclofenac,

Antibacterials – Sulphamethoxazole, Sulphadiazine, Sulphacetamide, Nalidixic acid.

[08]

Unit-V: Diuretics – Acetazolamide, Chlorthiazide; Frusemide, Spironolactone.

Diagnostic Aids: Iopanoic Acid

[08]

PHAR-361P

PHARMACEUTICAL CHEMISTRY -VI
(MEDICINAL CHEMISTRY-II)

PRACTICAL

1. Synthesis of selected drugs from the course content involving two or more steps.

2. Establishing the pharmacopoeial standards of the drugs synthesized.

3. Spectral analysis of the drugs synthesized.

BOOKS RECOMMENDED:
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.

**PHAR-362**

**PHARMACEUTICS-VII**
**(PHARMACEUTICAL TECHNOLOGY - II)**

**Unit-I :** 1. **Capsules:** Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsule, size of capsules, methods 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 dosage forms.

2. **Micro-encapsulation:** Types of microcapsule, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-acervation, multi orifice, spray drying, spray congealing, polymerisation, complex, formulation, emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

**Unit-II :** **Tablets:** (A) Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets. 
(B) **Coating of Tablets:** Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet. Stability kinetics and quality assurance.

**Unit-III :** (A) Approaches to Sustained and controlled release dosage forms. In-vitro methods of evaluation. 
(B) Formulation and evaluation of Opthalmic, Nasal and Ear products.

**Unit-IV :** **Parenteral Products :** Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation details, containers and closures and their selection. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and sealing of ampoules, vial, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.

**Unit-V :** **Surgical Products :** Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc, bandages, adhesive type, protective cellulosic hemostasis, official dressings, absorbable and non absorbable sutures, ligatures and catguts.

**Packaging of Pharmaceutical Products :** Packaging component types, specifications and methods of evaluation, stability aspects of packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

**PHAR-362P**

**PHARMACEUTICS-VII**
**(PHARMACEUTICAL TECHNOLOGY - II)**

**PRACTICAL**
1. Experiments to illustrate preparation, stabilization & physical evaluation of pharmaceutical products like powders, capsules, tablets, parenterals & microcapsules.
2. Evaluation of Materials used in pharmaceutical packaging.

**SUGGESTED PRACTICALS**
1. Preparation, Evaluation, Packing of the following dosage forms.
   a) Capsules : Chloramphenicol capsules IP
b) Microcapsules : Coacervation Phase separation (Temperature change)
c) Tablets : Uncoated – Paracetamol tablets IP
d) Tablets : Film coated – Ibuprofen tablets IP
e) Tablets : Enteric coated – Aspirin tablets
f) Parenteral : Disodium EDTA injection IP (vials)
g) Parenteral : Dextrose – NaCl IV infusion IP (Infusion boilers)
h) Parenterals : Water for infection IP (Ampoule)
i) Eye drops : Zinc sulphate IP
j) Eye ointment : Sulphacetamide Sodium IP

II - Formulation and evaluation of sustained release dosage forms – Aspirin Extended release (Matrix embedding method, Granules USP/NF coating of granules)

III - Evaluation of packages – containers & closures.

BOOKS RECOMMENDED
5. Herbert A. Liebermann & Leon Lachman, Theory & Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.

PHAR-363P

PHARMACOLOGY-II

Unit-I :
Pharmacology of CVS: Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics, Therapy of Shock. [09]

Unit-II :
Drugs Acting on Hemopoietic System

Drugs Acting on Respiratory System
Anti-asthmatic drugs, Anti-tussives & Expectorants, Respiratory Stimulants. [08]

Unit-III : NSAIDS & Anti-gout Drugs.
Diuretics [08]

Unit-IV : Autocoids: Histamine, 5HT and their antagonists, Prostaglandins, Thromboxans, Leukotrienes, Angiotensin and Bradykinin [08]

Unit-V : Drugs acting on GIT
Antacids and Antiulcer drugs, Laxatives and antidiarrhoeal Agents, Emetics and antiemetics. [07]

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PHARMACOLOGY-II

PRACTICAL
1. To record the dose response curve (DRC) of Acetylcholine using ileum of rat.
2. To study the parallel shift of DRC in presence of competitive antagonist on DRC of Ach using rat ileum.
3. To study effect of physostigmine on DRC of each on rat ileum.
4. To study the CRC of histamine on guinea pig on ileum preparation & study the effect of antihistaminics.

BOOKS RECOMMENDED:
7. Laurence, DR & Bannet PN; Clinical Pharmacology, Churchill Livingstone.
8. Rang MP, Date MM, Riter JM, Pharmacology Churchill Livingstone.

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PHARMACOGNOSY – III

Unit-I : (A) Study of the biological sources, cultivation, collection, Commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing.

Glycosides :
1. Saponins : Liquorice, Ginseng, Dioscorea, Coleus species. [04]
2. Cardioactive sterols : Digitals, Squill, Stropanthus & Thevetia. [03]
3. Anthraquinone Cathartics : Aloe, Senna, Rhubarb & Cascara. [03]

Unit-II : Others : Psoralea, Ammi majus, Ammi visnaga, Gentian, Saffron, Chirata, Quassia and Andrographis paniculata. [03]

(B) Utilization and production of phytoconstituents such as calcium sennsoides, Diosgenin, Solasodine & Podophyllotoxins. [03]

Unit- III : Studies of traditional drugs : Common Vernacular name, Biological sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and toxicological activity of marketed formulations of following indigenous drugs : Amla, Kantkari, Satavari, Tylophora, Bhilwa, Kalijiri, Vach, Rasna. [07]

Unit-IV : Punarnava, Chitrak, Apamarg, Gokhru, Shankpushpi, Brahmi, Methi, Lehsun, Palash, Guggul, Gymnema, Shilajit, Talsi, Nagarmotha, Majith, Malkanguni and Neem. [08]

Unit-V : Brief Introduction and principals of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia with special reference to. Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. [07]

PHAR-364 P

PHARMACOGNOSY - III

PRACTICAL
1. Identification of crude drugs listed in theory.
2. Microscopic study of some important glycoside containing drugs as outlined above, Study of powdered drugs.
3. Standardization of some traditional drug formulations.

**SUGGESTED PRACTICALS**
1. Morphology and microscopy (powder) of Liquorice along with its chemical tests.
2. Morphology of Aloe and chemical tests on Aloe-extracts.
3. Morphology and microscopy (powder) of Rhubarb
    b) Identification Tests for Guggul lipids.
9. To study the following standards-
    a) Loss on drying.
    b) Extractive values.
    c) Ash values.
    d) pH of 1% solution, in water and alcohol of any Ayurvedic formulation (solid) available in the market.
10. To perform above studies (exp. 10) in any liquid Ayurvedic formulation.
11. Preparation of medicated oil.

**PROJECT WORK**
A report on marketed preparations based on traditional drugs mentioned in theory.

**BOOKS RECOMMENDED :**
7. Medicinal plants of India I&II, Indian council of Medical Reasearch, New Delhi.
13. Indian Ayurvedic Pharmacopoeia, Govt. of India.

**PHAR-365**

**PROFESSIONAL COMMUNICATION-II**

**Unit-I**
1. Written skills:
   - Proposal writings formats.
   - Report writings
   - Business letters
   - Applications
   - Covering letters.
Curriculum Vitae Designing

Unit-II
2. Productivity, Time Management simulation exercise
3. Leadership Skills.
4. Team work ‘BSC’ – Boss, Subordinates & Collegues

Unit-III
5. Group Discussions (G.D)
   - Tips
   - GD

Unit-IV
6. Corporate behaviour, corporate expectation, office etiquettes.
7. Extempore

Unit-V
8. Interview Tips:-
   - What student is supposed to do before the interview, during the interview, after the interview
     & on the day of interview.
   - Various questions that may be asked in an interview.
   - Model interview (Video-shooting & displaying optional)
9. Exit Interview

BOOKS RECOMMENDED
1. Raman, Meenakshi & Sharma Sangeeta, Technical Communications- Principles & Practice, Oxford
   University Press.

PHAR- 366 : ENVIRONMENT & ECOLOGY

Unit-I
Environment studies
   A- Definition, scope & importance
   B- Natural Resources – renewable & non renewable
   C- Use, utilization, exploitation and associated problems of forests, Water resources, Mineral
     resources, Food resources, Energy resources, Land resources.
   D- Equitable use of resources for sustainable life style, role of an individual in conservation.

Unit-II
Ecosystems
A. Introduction, types features & functions of difference ecosystems- Forest Grassland, Desert and
   Aquatic.
B. Biodiversity & its conservation with special reference to India.

Unit-III
Environmental pollution- Air, Water, Soil, Marine, Noise, Thermal, Nuclear- Introduction causes and
   control measures.

Unit IV
Law related to Environmental Protection
Air (Prevention and Control of pollution )Act 1987
Water prevention & Control of Pollution Act. 1974

Unit-V
Environmental Protection Act -1986
Noise Pollution
Hazardous Wastes
Hazardous Chemical
Hazardous Microorganism
Biomedical Waste
Provisions applicable to drugs and cosmetic.

Reference

SEMESTER –VII

PHAR –471

PHARMACEUTICAL ANALYSIS -III

Unit-I :
Ultraviolet and Visible Spectrophotometry : Electronic, excitation, quantitative laws, deviation from Beer’s law, graphical presentation of data. Chromophores photometric error, instrumentation, single and double beam spectrohotometer.
Colorimetric methods : Chemistry of colorimetry, instrumentation, application (direct methods and indirect methods). Nephelometry & turbidimetry and densiometry. [08]

Unit-II :
Infra Red Spectrophotometry : Theory, characteristics absorbance, bands of organic functional groups, interpretation of infrared absorption spectra, preparation of sample, sample cells, IR instrumentation qualitative and quantitative applications in pharmaceutical analysis.
Flourimetric Analysis : Theory, quantitative description, experimental factors affecting fluorescence intensity, factors affecting IC and F directly, relationship of fluorescence to molecular structure, instrumentation, correction of spectra, pharmaceutical applications. [08]

Unit-III
Nuclear Magnetic Resonance Spectroscopy
An introduction to the theory of 1H-NMR, chemical shift & spin-spin coupling, spectra of (CH₃ CH₂ - OH, Cl-CH₂ OH, CH₃ – CHO, CH₃ (CH₂)₄ CH₃, C₆ H₆, CH₃ C₆H₅ ). [08]

Unit-IV
Mass Spectrometry
Introduction to mass spectra, molecular ion peak, fragmentation peaks, mass spectra of some simple compounds.
Flame Photometry
Origin of spectra, atomization and ionization, instrumentation, background emission, interference, qualitative & quantitative applications in pharmaceutical analysis. [08]

Unit-V
Theory, instrumentation and applications of:
Emission Photometry
Atomic absorption spectroscopy [08]

PHAR-471P
PHARMACEUTICAL ANALYSIS -III

PRACTICAL
1. Assay of at least 10 official formulation containing single and more active ingredients using instrumental techniques.
2. Interpretation of a few spectra.

BOOKS RECOMMENDED :
1. Pharmacopoeia of India, Ministry of Health, Govt of India.
8. Skoog V, Principles of Instrumental Analysis, Holler-Neimen

**PHAR – 472**

**PHARMACEUTICS-VIII**

*(BIOPHARMACEUTICS & PHARMACOKINETICS)*

**Unit-1:** Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation, development and clinical setting.

**Biopharmaceutics:**
(A) Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
(B) Factors influencing absorption – Physicochemical, physiological and pharmaceutical.
(C) Drug distribution in the body, plasma protein binding. [08]

**Unit-II:** Pharmacokinetics:
(A) Significance of plasma drug concentration measurement.
(B) Compartment model and Non-compartment model. Definition and Scope.
(C) Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – Nelson, Loo-Reigelman method. [08]

**Unit-III:**
(A) Volume of distribution and distribution coefficient.
(B) Compartment kinetics – One compartment and Preliminary information of multicompartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.
(C) Clinical Pharmacokinetics: Definition and scope [08]

**Unit-IV:**
(A) Dosage adjustment in patients with and without renal and hepatic failure.
(B) Pharmacokinetic drug interactions and their significance in combination therapy.

**Unit-V:** Bioavailability and Bioequivalence:
(A) Measures of bioavailability, C-max, and area under the curve (AUC).
(B) Review of regulatory requirements for conduction of bioequivalent studies. [08]

**PHAR-472P**

**PHARMACEUTICS-VIII**

*(BIOPHARMACEUTICS & PHARMACOKINETICS)*

**PRACTICAL**
4. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
5. *In vitro* evaluation of different dosage forms for drug release.
6. Absorption studies – *in vitro*.
7. Statistical treatment of pharmaceutical data.
SUGGESTED PRACTICALS
1. In-vitro drug release study of the given powder dosage form using various dissolution media.
2. In-vitro drug release study of the given uncoated tablet dosage form using different dissolution media.
3. In-vitro drug release study of the given capsule dosage form using various dissolution media.
4. In-vitro drug release study of the given film coated dosage form using various dissolution media.
5. In-vitro dissolution study of the given sustained release dosage form.
6. In-vitro dissolution study of the given fast release (M.D, Dispersible etc.) dosage form.
7. To study the effect of hardness of tablet on dissolution rate.
8. To study the effect of various diluents on dissolution rate of dosage form (Tablets, Capsules, Ointment etc.).
9. To study the effect of formulation on drug release (powder, suspension etc.).
10. To determine the % protein binding of the given drugs.
11. To determine the effect of protein binding on drug bioavailability.
12. To calculate various Pharmacokinetic parameters from the given zero order drug release data.
13. To calculate various Pharmacokinetic parameters from the given first order drug release data.
14. To calculate the various Pharmacokinetic parameters from the given blood data of I.V bolus injection (one compartment model).
15. To calculate various Pharmacokinetic parameters from the given urinary excretion data of I.V bolus injection using both methods (Rate of elimination & sigma minus method one compartment model).
16. To study the in-vitro drug-drug interaction.
17. To study the passive diffusion of the given drug using cellophane membrane.
18. To study the passive diffusion of the given drug using egg or goat membrane.
19. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosage form.

DEMONSTRATION EXPERIMENTS
1. Dissolution Apparatus.
2. Preparation of Buffers & membranes.
3. Use of semilog paper.

BOOKS RECOMMENDED:
1. Notari, R.E, Biopharmaceutics and Pharmacokinetics – An introduction Marcel Dekker Inc. N.Y.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.

PHAR – 473

PHARMACOLOGY -III

Unit-I : Pharmacology of Endocrine System
Hypothalamic & pituitary hormones, Thyroid hormones & Thyroid Drugs, Parathormone, Calcitonin & Vitamin D, Insulin, oral hypoglycemic agents & glucagon. [07]

Unit-II : ACTH & Cortico steroids, Androgens & anabolic steroids, Estrogens, Progesterone & Oral Contraceptives, Drugs acting on uterus. [08]

Unit-III : Chemotherapy
General Principles of Chemotherapy, Sulfonamides, Cotrimoxazole, Quinolones, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, Tetracyclines,Macrolides. [08]
Unit-IV : Chemotherapy of Parasitic infections, Tuberculosis, Leprosy, Malaria, Fungal infections, Viral diseases, Introduction to Immunodulators and Chemotherapy of Cancer. [10]

Unit-V : Principles of Toxicology
Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous & atropine poisoning, Heavy metal Antagonists. [07]

PHARMACOLOGY- III

PRACTICAL
1. To calculate the pA2 value of Atropine & chlorpheniramine.
2. Bioassay of Ach, histamine & oxytocin on suitable isolated preparations using matching assay, bracketing assay, three point assay & four point assay.

SUGGESTED PRACTICALS
Bioassay of histamine and acetylcholine using matching and interpolation method on rat guinea pig ileum.

BOOKS RECOMMENDED :
5. Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press.
8. Laurene, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.

PHARMACEUTICAL CHEMISTRY –VI
(MEDICINAL CHEMISTRY - III)

Mode of action, uses, structure- activity relationship of the following classes of drug(Synthetic procedures of individually mentioned drugs only).

Unit-I :
   (A) Androgens and Anabolic steroids – Testosterone, Stanazolol.
   (B) Estrogens and Progestational agents – Progesterone, Estradiol.
   (C) Adrenocorticoids – Prednisolone, Dexamethasone, Betamethasone. [08]

Unit-II :
Antibiotics-Penicillins, Semi-synthetic , penicillins, streptomycin, tetracyclines, Cephalosporins, Chloramphenicol, Fluroquinolones.
Antimycobacterial Agents: PAS, Ethambutol, Isoniazid, Dapsone [08]

Unit III:
Antimalarials: Choloroquine, Primaquine, Pyrimethamine
Antiamoebics: Metronidazole, Tinidazole, Diloxanide
Antiseptics & Disinfectants – Benzalkonium chloride
Anthelmintics- Mebendazole

Antifungals


Antivirals – Amantadine, Acyclovir, Lamivudine.

Prostaglandins – Misoprostol, Carboprost.

Unit-V Thyroid and Antithyroids – Carbimazole, Levothyroxine, Propylthiouracil, Methimazole. Insulin & Oral Hypoglycaemics – Chlorpropamide, Metformin, Tolbutamide, Glybenclamide. [08]

BOOKS RECOMMENDED :
1. Pharmacopoeia of India, Ministry of Health, Govt. of India.

PHAR-475

PHARMACOGNOSY-IV

Unit-I : 1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes adulterants, uses, diagnostic macroscopic & microscopic features & specific chemical tests of following alkaloid containing drugs.

(A) Pyridine-piperidine : Tobacco, Areca & Lobelia.

(B) Tropane : Belladona, Hyoscyamus, Datura, Coca & Withania.

(C) Quinoline & Isoquinoline : Cinchona, Ipecac & Opium.

(D) Indole : Ergot, Rauwolfia, Catharanthus & Nux-vomica. [08]

Unit-II :

(E) Imidazole : Pilocarpus.

(F) Steroidal : Veratrum & Kurchi.

(G) Alkaloidal amine : Ephedra & Colchicum.

(H) Glycoalkaloid : Solanum.

(I) Purines : Coffee & Tea

(J) Quinazoline : Vasaka. [08]

Utilization & production of phytoconstituents such as – Tropane Alkaloids, Isoquinoline & Quinoline Alkaloids.

Unit-III


(B) Role of Medicinal & aromatic plants in National Economy. [08]

Unit-IV

Biological sources, preparation, Identification tests and uses of following enzymes – Diastase, papain, Penicillinase, Hyalluronidase, Streptokinase.

Plant Bitters & Sweeteners. [08]

Unit-V : Introduction, classification & study of different chromatographic methods. Application of chromatographic techniques in evaluation of herbal drugs.
Historical development of plant tissue culture, type of culture, Nutritional requirement, growth & their maintenance. Application of plant tissue culture in pharmacognosy.

**PHAR-475P**

**PHARMACOGNOSY -IV**

**PRACTICAL**
1. Identification of crude drugs listed above.
2. Microscopic study of characters of any 8 selected drugs given in theory in entire and powder form.
3. Chemical evaluation of powdered drugs & Enzymes.
4. Chromatographic studies of some herbal constituents.
5. Some experiments in plant tissue culture.

**SUGGESTED PRACTICALS**
1. To study the morphology and microscopy of Datura and Withania.
2. To study the morphology and microscopy of Ipecac and Rauwolfia.
3. To study the morphology and microscopy of Catharanthus and Nux-vomica.
4. To study the morphology and microscopy of Ephedra and Kurchi.
5. To study the morphology and microscopy of Solanum and Vasaka.
    b) Transverse section of Catharanthus leaf and Kurchi bark.
7. To study the TLC profile of Catharanthus leaf.
8. To study the TLC profile of Withania root.
9. Chemical test of Tea, Tobacco, Datura and Withania.
11. Introduction of plant-tissue culture techniques on laboratory scale.
12. Preparation of Agar slants.
13. To grow callus in any defined media.

**PROJECT:**
World wide trade of medicinal plants. (Monograph).

**BOOKS RECOMMENDED :**

**SEMESTER – VIII**

**PHAR –481**

18
PHARMACEUTICAL BIOTECHNOLOGY

Unit-I : Immunology and Immunological preparations
Principles, Antigen and haptens, immune system, Cellular, humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG. [08]

Unit-II : Genetic Recombination
Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications, development of hybridoma for monoclonal antibodies, study of drugs produced by biotechnology such as activase, humulin, Humatrope. [08]

Unit-III : Antibiotics
Historical development of antibiotics, Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics fermenter, its design, control of different parameters. Isolation of mutants, factors affecting mutation. [08]

Unit-IV : Microbial Transformation
Introduction, types of reactions mediated by microorganisms, Design of Bio-tranformation process, selection of organisms, biotranformation processes and its improvements with special reference to steroids. [08]

Unit-V : Enzyme immobilization
Techniques of immobilization of enzymes, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodaranse, amylases and proteases. Immobilization of Bacteria and plant cells. [08]

BOOKS RECOMMENDED :

PHAR –482

NATURAL PRODUCTS

Unit-I :
1. Chemical & Spectral approaches to simple molecules of natural origin.
2. Biogenetics Investigations and basic metabolic pathways, (alkaloids, terpenes, steroids) Brief introduction to biogenesis of secondary metabolites of Pharmaceutical importance. [08]

Unit-II
Extraction, Isolation & Chemistry of –
   i) Glycosides - Digitoxin, Digoxin, Hecogenin, Diosgenin & Sarasapogenin
   ii) Lignans
   iii) Quassinoids
   iv) Flavonoids (Quercetin) [08]

Unit-III :
Alkaloids – Atropine & related compounds, quinine, reserpine, morphine, papaverine, ephedrine, ergot, and Vinca Alkaloids.
Natural Allergens, Photosensitizing agents and fungal toxins. [08]

Unit-IV:
Extraction, Isolation & Chemistry of –
Terpenoids- Camphor, Menthol, Citral, β- Carotene, α -Tocopherol, α-Pinene. [03]
Unit-V
Herbal Cosmetics and their formulation. [02]
Recent developments of natural products used as anticancer agents, antidiabetics and immunomodulators.

**PHAR-482P**

**NATURAL PRODUCTS**

**PRACTICAL**
1. Laboratory experiments on Isolation, separation, purification of various groups of chemical constituents of Pharmaceutical significance.
2. Exercises on paper & thin layer chromatographic evaluations of herbal drug constituents.
3. Extraction of volatile oils & theirs chromatographic profiles.

**SUGGESTED PRACTICALS**
1. Isolation of caffeine from Tea leaves.
2. Isolation of piperine from Black Pepper.
3. Isolation of Hesperidin from Orange Peel.
4. Isolation of Clove oil from clove.
5. Isolation of Caraway oil from caraway.
6. Isolation of cumin oil from cumin.
7. To study the TLC profile of extracted oils.
8. To performs the column chromatography of any available herb.
9. To study the paper chromatographic profile of glycone portion separated from senna.
10. To Isolate the active constituent of any available drug with the help of preparative TLC.
11. Quantitative determination of Ascorbic acid present in Amla. (Fresh/ Dry).

**BOOKS RECOMMENDED**
2. Sim, Medicinal Plant Alkaloids & Glycosides.
6. Pharmacopoeia of India.

**PHAR-483**

**PHARMACEUTICAL INDUSTRIAL MANAGEMENT**

**Unit-I**
1. **Concept of Management**: Administrative Management (Planning, Organising Staffing Directing and Controlling). Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/ Morale) Principles of Management (Co-ordination, Communication, Motivation, Decision making, leadership, Innovation Creativity, Delegation of Authority / Responsibility. Record Keeping), Identification of key points to give maximum thrust for development and perfection. [12]

**Unit-II**
**Economics**: Principles of economics with special reference to the Laws of demand and supply, demand schedule, demand curves labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods. [03]

Unit-III  
3. Pharmaceutical Marketing: Functions, buying, selling, transportation, storage financed feedback information, channels of distribution, wholesale, retail, department store, multiple shop and mail order business. [04]  
4. Salesmanship: Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation, compensation to the pharmacist. [04]  

Unit-IV  
5. Market Research  
(B) Market segmentation & Market targeting. [06]  

Unit-V  
6. Materials Management: A brief exposure of basic principles of management major areas, scope, purchase, stores, inventory control and evaluation of materials management. [04]  

BOOKS RECOMMENDED:  
3. Datta A.K., Material Management / PHI.  
4. Chadwick Leslie, The essence of management accounting / PHI.  
5. Massie L. Joseph Essentials of Management / PHI.  
8. Daver Rustam S. Salesmanship and Publicity –/ Vikas.  
11. Vidya sagar Pharmaceutical Industrial Management, Pharma Book Syndicate  

PHAR- 484  

HOSPITAL PHARMACY  

Unit-I: Organization and Structure: Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist. Pharmacy and therapeutic committee, Budget preparation and implementation.  

Hospital Formulary: Contents, preparation and revision of hospital formulary.  

Unit-II: Drug Store Management and Inventory Control: Organization of drug., Types of materials stocked, storage conditions.  

Purchase and Inventory control: Principles, purchase procedures, purchase order, procurement and stocking.  

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Unit-III : Central Sterile Supply Unit and their Management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.

Manufacture of Sterile and Nonsterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula card, Production control, Manufacturing records.

Unit-IV: Drug information service: Sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of information, Medication error.

Records and Reports : Prescription filling drug profile, Patient medication profile, case on drug interaction & adverse reactions, idiosyncratic cases etc.

Unit-V: Drug distribution systems in Hospitals : Out-patient dispensing, methods adopted, Dispensing of drugs to in-patients. Types of drug distribution systems Charging Policy, labeling, Dispensing of drugs to ambulatory patients, Dispensing of controlled drugs.


BOOKS RECOMMENDED

PHAR –485
ELECTIVE
Any one of the following :
(A) Standardisation of herbal drugs.
(B) Drug design.
(C) Clinical; Pharmacy and Drug interactions
(D) Pharmaceutical marketing.
(E) Pharmaceutical Packaging
(f) Novel drug delivery system
(G) GMP, Quality Assurance & Validation

(A) STANDARDISATION OF HERBAL DRUGS
Unit I – Commerce and quality control of natural medicinal plants products, organoleptic,microscopical, physical & chemical evaluation of crude drugs. [08]
Unit-II - Standardisation of plant material as per WHO guidelines. [08]
Unit-III -Methods of extraction and modern techniques for the isolation, purification, separation estimation and characterisation of active plant constituents. [08]
Unit-IV -Analysis of official formulations derived from crude drugs including some ayurvedic preparations. [08]
Unit-V -General methods of screening of natural products for following biological activity:
   a) Anti-inflammatory b) Hypoglycaemic c) Antibacterial
d) Antifertility e) Psychopharmacological [08]

BOOK RECOMMENDED
1. Trease, G.E. Evans W.C., Pharmacognosy ELBS.
2. Tyler Varro. E., Brady Lynn. R. Robbers J.E. Pharmacognosy
4. Harborne Phytochemical methods of chemical analysis .
5. Pharmacoeplial standards for Ayurvedic formulations CCRAS, Delhi.
7. Lala P.K., Elements of chromatography
8. Mottal.A.C. Clerk’s isolation & identifications of drugs
11. Peach K. & Tracey MV, Modern methods of plant analysis
13. Indian herbal pharmacopoeia.

(B) DRUG DESIGN

Unit-I
A general study of the approaches to drug design- method of variation, study of the use of Biochemical & Physiological information involving new drugs. [08]

Unit-II
Physicochemical properties in relation to drug action; metabolic transformation of drugs and its role in development of new drug molecules; Metabolic antagonism. [08]

Unit-III
Stereochemical aspects of drug receptor interactions and mechanism of drug interaction. Isosterism and bioisosterism as guides to structural variations; Concepts of conformational analysis and its role in design and development of new drug molecules. [08]

Unit-IV
Principles of drug design: Analogue synthesis versus rational design; discovery of lead compounds, Pharmacophoric identification, Prodrugs and soft drugs. [08]

Unit-V
QSAR and introduction to molecular modeling, Computer Aided Drug Design. [08]

BOOKS RECOMMENDED:

(C) CLINICAL PHARMACY AND DRUG INTERACTIONS

Unit-I
1. Introduction to Clinical Pharmacy. [08]

Unit-II
2. Basic concepts of pharmacotherapy,
   Clinical Pharmacokinetics and individualization of Drug Therapy, Drug Delivery, Systems and their Biopharmaceutic & Therapeutic Considerations, Drug use during Infancy and in the Elderly (Pediatrics & Geriatrics). [08]

Unit-III
Drug use during Pregnancy, Drug induced Diseases, The Basics of Drug Interactions, General Principles of Clinical Toxicology, Interpretation of Clinical Laboratory Tests. [08]

Unit-IV
3. Important Disorders of Organ Systems and their Management:
Gardiovascular Disorders-Hypertension, Congestive Heart Failure, Angina, Acute Myocardial Infarction, Cardiac arrhythmias, CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression, Respiratory Disease-Asthma, Gastrointestinal Disorders-Peptic ulcer, Ulcerative colitis.

Unit-V

4. Therapeutic Drug Monitoring.

5. Concept of Essential Drugs and Rational Drug use.

BOOKS RECOMMENDED
4. Laurence, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
8. Davidson’s Principles and Practice of Medicine, ELBS/Churchill Livinstone.

(D) PHARMACEUTICAL MARKETING

Unit-I Principles of marketing management, Introduction to pharmaceutical marketing, Identification of the marketing, Market behaviour, Prescribing habits of physician, Patient motivation, Market analysis.

Unit-II Drug development and the marketing research interface, Diversification and specialisation, Marketing generic drugs.

Unit-III Economic and competitive aspects of pharmaceutical industry- Advertising, Detailing, Retail competition, International marketing.

Unit-IV Distribution channels in pharmaceutical marketing – Manufacturter, Wholesaler, Retailer, Hospital & Government agencies, Selection of stockists and distributors.

Unit-V Controls- Internal control and external control.

BOOKS RECOMMENDED

(E) PHARMACEUTICAL PACKAGING

Unit-I
1. New concepts in pharmaceutical packaging.
2. Package systems, package design research.

Unit-II
4. Blister and strip packaging.

Unit-III
5. Testing of containers & closures, Pharmacopoeial tests and specifications, Defects in packages.
7. Ancillary materials used in packaging. [08]

**Unit-IV**
9. Packaging of Parenterals, Ophthalmic and aerosols. [08]

**Unit-V**
10. Corrugated fibre board materials, Pointing requirements, label and leaflets preparation, Legal requirement. [08]

**BOOKS RECOMMENDED:**
1. Ross, Packaging of Pharmaceuticals.
3. Griffin, Drug and cosmetic Packaging.

(F) NOVEL DRUG DELIVERY SYSTEM

**Unit-I**
1. Theory of controlled release drug delivery systems.

**Unit-II**
3. Carriers for drug delivery systems, Prodrugs, Physical, chemical and biomedical engineering approach to achieve controlled drug delivery.
4. Microencapsulation: Methods, kinetics of drug release from microcapsules technology and applications. [08]

**Unit-III**
6. Implants and inserts: Types, design and evaluation methods, Osmotic pumps. [08]

**Unit-IV**
7. Targeted Drug delivery systems: Concept of drug targeting, importance in therapeutics, methods in drug targeting, drug immobilization techniques, nanoparticles, liposomes, neosomes, pharmacosomes and erythrocytes. [08]

**Unit-V**
8. Advances in drug delivery systems. An Introduction to buccal, nasal, ocular, pulmonary colonic delivery, etc. [08]

**BOOKS RECOMMENDED**
4. Robinson and Vincent, Controlled Drug Delivery.
5. Robinson, Sustained and Controlled Drug Delivery Systems.
8. Deasy, Microencapsulation and Related Processes.
10. Lisbeth, Illum & Davis, Polymers in Controlled Drug Delivery.

(G) GMP, QUALITY ASSURANCE & VALIDATION

**Unit-I**
1. Requirements of GMP, CGMP1, GLP, USFDA, WHO guidelines and ISO 9000 series. [08]
Unit-II
2. Documentation- Protocols, Forms and maintenance of records in Pharmaceutical industry. [08]
3. Preparation of documents for new drug approval and export registration.

Unit-III
4. Basic concept of quality assurance, Quality assurance systems, Sources and control of quality variation- raw materials, containers, closures, personnel, environment etc [08]

Unit-IV

Unit-V
6. In process quality control tests, IPQC problems in pharmaceutical industries.
7. Sampling plans, Sampling and operating characteristics curves. [08]

BOOKS RECOMMENDED:
2. OPPI, Quality Assurance.
4. Florey, Analytical Profile of Drugs (All volumes).
5. Indian Pharmacopoeia.

PHAR-485 P
Project on Elective
Revised Syllabus

III\textsuperscript{rd} and IV\textsuperscript{th} Year
[Effective from the session 2006-07]

BACHELOR OF PHARMACY