Bachelor of Pharmacy 2nd year (3rd Semester) WEF 2013 – 2014 Session onwards

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**Practical Day to Day Evaluation**

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T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test
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2.4 Credits – ESE
Bachelor of Pharmacy 2\textsuperscript{nd} year (4\textsuperscript{th} Semester) WEF 2013 – 2014 Session onwards

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2.4 Credits – ESE
Bachelor of Pharmacy 3\textsuperscript{rd} year (5\textsuperscript{th} Semester) WEF 2013 – 2014 Session onwards

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2.4 Credits – ESE
Bachelor of Pharmacy 3rd year (6th Semester) WEF 2013 – 2014 Session onwards

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UNIT-I:

METHODS OF PREPARATION WITH MECHANISM, PROPERTIES AND MECHANISM OF NAME REACTION ASSOCIATED WITH:

(i) Active methylene compounds (acetoacetic ester and malonic ester) and their synthetic importance.
(ii) α,β-unsaturated carbonyl compounds.
(iii) Polynuclear hydrocarbons-Napthalene, anthracene and phenantherene.
(iv) Polymers and polymerisation.

UNIT-II:
Carbohydrate: Monosaccharide:- Glucose (mutarotation, ring structure of glucose, configuration of monosaccharides). (08)

UNIT-III:
Disaccharides (Sucrose and maltose), Polysaccharides (Starch and cellulose) (08)

UNIT-IV:
HETEROCYCLIC COMPOUNDS: Nomenclature, Chemistry, preparation, properties of 5-membered heterocycles with one hetero atom (Pyrrole, Furan and Thiophene), 5-membered heterocycles with two hetero atom (Imidazole, Thiazole, Oxazole, Pyrazole) (08)

UNIT-V:
Nomenclature, Chemistry, preparation, properties of 6-membered heterocycles with one hetero atom (Pyridine, Pyran), 6-membered heterocycles with two hetero atoms (Pyrimidine, Piperazine) Benz fused heterocycles (Quinoline, Isoquinoline, Indole) (08)

PHR-301P
PRACTICAL
ORGANIC CHEMISTRY-II
(PHARMACEUTICAL CHEMISTRY-III) LAB.

1. Identification of organic compounds and their mixture with derivatization. (Not more then two)

BOOKS RECOMMENDED:-
3. Finar I.L. Organic chemistry, Pearson education, New Delhi

UNIT-I:
a) Selection of plant and equipments in unit operations  
b) A study of the following Valves – Plug Cocks, Globe, Gate, Diaphragm, QO, Check valves  
c) A study of the following Pumps- Air lift, Jet, Piston, Plunger, Diaphragm, Reciprocating,  
Rotary, Centrifugal pumps. (08)  

UNIT-II: 
HUMIDITY, VENTILATION AND AIR CONDITIONING SYSTEMS (HVAC):- Basic concepts & definitions, Wet bulb & Dry bulb thermometer, Adiabatic saturation temperature, Psychometric charts & Measurement of humidity, Application of humidity measurement in pharmacy, Equipment for dehumidification operations.  
Principles, Materials of constructions and Applications of Refrigeration and Air-conditioning. (08)  

UNIT-III:  
DRYING: - Moisture content , Equilibrium relative humidity & Mechanism of drying, Rate of drying & time of drying calculations, Classifications of dryers, Principle, material of construction, applications advantages and disadvantages of tray, fluidized bed, Rotary, Drum, Vacuum, Spray and Freeze dryer.  
EVAPORATION: - Basic concepts of phase equilibrium, Factors affecting evaporation, principle, materials of construction, Applications, advantages and disadvantages of Climbing and falling film evaporators, Evaporating pan, Vacuum evaporators, Horizontal and Vertical evaporators. (08)  

UNIT-IV:  
DISTILLATION:- Raoult’s law, Phase diagrams, Simple, Steam, & Flash distillation, Principle of McCabe Thiele method of calculation of number of theoretical plates, Equipment for rectification, Azeotropic, Extractive & molecular distillation. (08)  

UNIT-V  

PHR-302P  
UNIT OPERATIONS-II  

(08)  
Experiments based on drying, distillation, evaporation, crystallization, and humidity charts to be performed.  

BOOKS RECOMMENDED:-  
2. McCabe W.L, Smith J.C. & Peter Harriot. Unit operations of chemical engineering. 5th Ed.  
4. Cooper J.W. & Gunn G., Tutorial Pharmacy, CBS Publisher & distributors New Delhi  
7. 5. Subramanian C.V.S, Pharmaceutical engineering, Vallabh Prakashan, Delhi.  
PHR- 303
UNIT-I:
PHYSICAL PHARMACY-II
(PHARMACEUTICS-III)

MICROMERETICS AND POWDER RHEOLOGY: Average particle size, Particle size distribution, number and weight distribution, particle number; methods for determining particle size – optical microscopy, sieving, sedimentation, particle volume measurement, shape, specific surface; methods for determining surface area, air permeability, adsorption; derived properties of powders- porosity, packing arrangement, densities, bulkiness and flow properties, pore size. (08)

UNIT-II:
RHEOLOGY: Newtonian systems-Newton’s Law, kinematics viscosity, effect of temperature; non-Newtonian systems- plastic, pseudo plastic, dilatant; thixotropy- thixotropy in formulation; determination of viscosity; choice of viscometer, capillary, falling sphere, cup & bob, plate & cone viscometers, application of rheology in pharmacy. (07)

UNIT-III:
SURFACE AND INTERFACIAL PHENOMENON: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions (capillary rise method, drop number method, drop weight method, Wilhelm plate method), spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid-liquid interfaces, complex films, electrical properties of interface. (08)

UNIT-IV:
DISPERSION SYSTEMS:
(a) COLLOIDAL DISPERSIONS: Definition, types, properties of colloids-optical, kinetics, electrical; protective colloids, applications of colloids in pharmacy.
(b) SUSPENSIONS: 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, stability.
(c) EMULSIONS: Types, theories of emulsification, physical stability, preservation, rheological properties, pharmaceutical applications of emulsions, microemulsions. (10)

UNIT-V:
STABILITY: Decomposition of medicinal agents- Influence of light, temperature and medium, half life, shelf life; stabilization of medicinal agents, accelerated stability and stress testing, ICH guidelines. (07)

Practicals based on the above mentioned theory topics.

BOOKS RECOMMENDED:
5. Lippincott, William and Wilkins, Philadelphia.
PHR-304

Unit-I:

PHARMACOGNOSY-I

A) The origin of Pharmacognosy, Present status and scope.
B) Sources of Drug: Biological and geographical sources of drugs.
C) Classification of Drugs: Alphabetical, Morphological, taxonomical, chemical & Pharmacological, chemo taxonomical. (08)

Unit-II:

Plant Taxonomy: - Study of the following families with special reference to medicinally important plants: Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae. (08)

Unit-III:

Culivation, Collection, Processing & Storage of crude drugs:
A.- Factors influencing cultivation of medicinal plants, humidity, rainfall, irrigation, Type of Soils & fertilizers, fertilization, pest and pest control.
B.- Plant growth regulators. (08)

Unit-IV:

Adulteration and Quality Control of crude drugs:
A.- Causes and types of Adulteration, Organoleptic, Microscopic, Biological, Chemical and Physical method of evaluation.
B. –WHO and current Indian Pharmacopoeial guidelines for the standardization of medicinal plants. (08)

Unit-V:

Systematic Pharmacognostic Study of the Following:
a) Carbohydrates and derived products: Agar, Guar gum, Xanthum gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia, Tragacanth, Alginates, and Katir. (08)

PHR-304P

PHARMACOGNOSY-I LAB.

1. Study of Plants belonging to families Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae
2. Microscopical measurement of starch grains (wheat, maize, starch, potato),
3. Various types of calcium-oxalate crystals, their study and microscopical measurements (Rhubarb, Senna, Liquorice etc.)
4. Determination of leaf constant such as Stomatal index, Stomatal numbers, Veinislet numbers, Veinintermination numbers and Palisade ratio
5. Chemical Tests of Agar, Acacia, Sterulia and Tragacanth., Pectin, Starch and Honey.
6. Swelling factor and average wt. of Isapaghula husk.
7. Physical characteristics of fixed oils.
8. Preparation of herbarium sheets.

BOOKS RECOMMENDED:
1. Trease. GE & Evans WC, Pharmacognosy, Bailleire tindall Eastbourne. UK. a. 6
Unit -I
Digestive system – Parts of digestive system, their structure and functions. Various gastrointestinal secretions & their role. (08)

Unit -II
Pathology of disorders related to digestive system Peptic Ulcer, Ulcerative colitis, Crohns disease, Zollinger- Ellison syndrome, Amoebiasis, typhoid, Hepatitis, Cirrhosis of liver, Pancreatitis. (08)

Unit-III
Central Nervous System: Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain. Cranial nerves and their functions. (08)

Unit-IV
Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission the A.N.S. (08)

Unit-V
Demography and Family Planning, Medical termination of pregnancy.
First Aid: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods. (08)

BOOKS RECOMMENDED
1. Tortora, Principles of Anatomy & Physiology, Wiley
6. Zdanovich Martin, Essentials of Pathophysiology for Pharmacy, CRC
12. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune.
B.Pharm 2nd year (IV Semester)

PHR-401

PHARMACEUTICAL ANALYSIS-II

Theoretical considerations and application in drug analysis and quality control by the following analytical techniques (assays included in the latest edition of Indian Pharmacopeia).

UNIT-I:
A. Non-aqueous titration
B. Diazotisation titrations (08)

UNIT-II:
Miscellaneous methods of analysis:, Karl-Fischer titration, Oxygen flask combustion, Kjeldahl method of nitrogen estimation. (08)

UNIT-III:
Principle, Instrumentation and Applications of: Potentiometry, Conductometry, Polarography, Amperometry, Electrophoresis. (08)

UNIT-IV:
Theory, Instrumentation and Applications of: Atomic absorption spectroscopy, Flame Photometry. (08)

UNIT-V:
Principle, instrumentation and pharmaceutical applications of chromatography such as Paper column, Chromatography, TLC. (08)

PHR-401P

PHARMACEUTICAL ANALYSIS-II LAB

2. Exercises based on paper, column and thin-layer chromatography.
3. Exercises involving diazotization, Karl-Fischer methods.
4. Determination of Sodium, Potassium and Calcium ion by Flame Photometry.

BOOKS RECOMMENDED:
2. Vidya Sagar, Basics of Drug Analysis, PharmaMed Press
5. Pharmacopoeia of India, published by The Controller of Publications, Delhi.
PHR-402
ANATOMY PHYSIOLOGY AND PATHOPHYSIOLOGY –IV

Unit-I –
Respiratory System – Anatomy & function of respiratory structures, Mechanism of respiration, regulation of respiration, pathophysiology of Asthma, Pneumonia, Bronchits, Emphysema, Tuberculosis. (08)

Unit-II –
Cardiovascular System – Functional Anatomy of heart, conducting system of heart, cardiac cycle, ECG (Electro cardiogram). Pathophysiology of hypertension, Angina, CHF, myocardial infarction, cardiac arrhythmias, Ischaemic heart disease, Arteriosclerosis. (08)

Unit-III –
Cell injury & Adaptation – Courses of cell injury, pathogenesis & morphology of cell injury. Cellular Adaptation – Atropy, hypertropy, aplasia, metaplasia, & dysplasia, intracellular accumulation & pathophysiology of Neoplasm. (08)

Unit IV –
Basic mechanisms involved in the process of inflammation and repair Alterations in vascular permeability and blood flow, migration of WBC’s , mediaters of inflammation. Brief outline of the process of repair (08)

Unit-VPathophysiology
of Joints disorder – Arthritis, gout, myasthenia gravis, spasticity,tetany, fatigue.
Pathophysiology of anaemia, AIDS, hypersensitivity, allergic conditions, physhosis, epilepsy, Parkinson & Alzeimer’s diseases pathophysiology of cataract, glaucoma etc. (08)

BOOKS RECOMMENDED
1. Tortora GJ, & Anagnodokos NP, Principles of Anatomy & Physiology, Wiley
2. Mc Corry, Essentials of Human Physiology for Pharmacy, 2nd Ed, CRC
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.11
Unit-I –
STUDY OF THE SOURCES, PHYSICAL AND CHEMICAL TEST OF IDENTITY, SALIENT MICROSCOPIC FEATURES AND USES OF THE FOLLOWING:
b) Fixed oil, Fats and Waxes: Almond, Castor oil, Cotton seed oil, Sesame oil, Olive oil, Cord liver oil, Arachisoil, Chaulmoogra oil, Neem oil, Fish liver oil, Lard, Lanolin, Bees wax, Lard, Cocoa butter, Kokum butter and wool fat. (08)

Unit-II –
PHYTOCHEMICAL SCREENING:
(a) Preparation of extract
(b) Screening of alkaloids, saponins, cardinolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthrquinones, cynogenetic glycoside, amino acid in plant extracts. (08)

Unit-III –
SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING DRUGS: Resins: Colophony, Podophyllum, Jalap, Canabis, Capsicum, Myrrh, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger, Guggle, myrrh, storax. (08)

Unit-IV –
Utilization and role of aromatic plant in national economic Volatile oil: Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamam, Valerian, Musk, Palamarosa, Gaultheria, Sandalwood, cumin, jatamansi. Cellulose and Cellulose derivative. (08)

Unit-V –
Tannins: Gambir, Black & Pale catechu, Gall, Myrobalam, Bahera, Arjuna, Tannic Acid, Amla, Ashoka Bark and Terocarpus. (08)

PHR-403P
PHARMACOGNOSY-II LAB

1. Study of fibers, along with chemical test.
2. Morphology and Microscopic evaluation of some medicinal crude drugs and their powders mentioned in theory with their chemical test.
3. General chemical test for alkaloids, glycosides, steroids, flavonoids and tannins.
4. To prepare a report on an allotted topic.
5. Study and chemical test of pharmaceutical aids

BOOKS RECOMMENDED:
1. Trease. GE & Evans WC, Pharmacognosy, Bailleire tindall East bourne. UK
2. Fischer, Modern Phytochemical Methods, Springer
10. Tyler. VE, Pharmacognosy, Le & Febiger, Philadelphia.13
PHR-404
CHEMISTRY OF NATURAL PRODUCTS

Different techniques of extraction and isolation of natural compounds. Introduction, classification and chemistry of the mentioned compounds.

UNIT-I:
A: - Glycosides: Salicin, amygdalin, digitalis & strophanthus (Structural features)
B: - Alkaloids: Atropine, Nicotine, Quinine. Structural features of morphine & reserpine. (10)

UNIT-II:
Steroids: Structural elucidation of cholesterol & Vit D, Structural features of corticoids, sex harmones, ergosterol, and saponin. (08)

UNIT-III
B: - Lipids and fatty acids: Physiochemical properties and significance of lipids and fats, Determination of acid, saponification, ester and iodine value and their significance in pharmacy. (06)

UNIT-IV
Terpenoids : Citral, menthol and camphor. (08)

UNIT-V
Amino acids, proteins: Preparation, properties and end group analysis. Protein structure (Primary, Secondary, tertiary and quaternary polypeptides) (08)

CHEMISTRY OF NATURAL PRODUCTS

1. Isolation of natural organic compounds from medicinal plants (Isolation of caffeine from Tea leaves,
2. Isolation of piperine from Black Pepper, Isolation of Hesperidin from Orange Peel, Isolation of Clove oil from clove, Isolation of Caraway oil from caraway, Isolation of cumin oil from cumin.)
3. Extraction of essential oils
4. Analysis of fixed oils (acid value, saponification value, ester value, and iodine value)
5. Identification test of cholesterol.

BOOKS RECOMMENDED:
1. Manitto, Biosynthesis of Natural Products, Wiley India
2. Praveen Kumar, Natural Products a Practical Manual, PharmaMed Press
5. Indian Pharmacopoeia (Latest Edition)
UNIT-I:
INTRODUCTION:
a) Pharmaceutical Legislations – A brief review.
b) Drugs and Pharmaceutical Industry – A brief review.
c) Pharmaceutical Education – A brief review.
d) Pharmaceutical Ethics – A brief review.
e) Pharmacy Act 1948. (08)

UNIT-II:
AN ELABORATE STUDY OF THE FOLLOWING:
a) Drugs and Cosmetics Act 1940 and rules 1945 - Manufacturing, distribution and marketing, approval of manufacturing and quality control chemist, schedules.
b) Drugs Price Control Order 1995. (08)

UNIT-III:
AN ELABORATE STUDY OF THE FOLLOWING:
b) Drugs and Magic remedies (Objectionable Advertisements) Act 1954. (08)

UNIT-IV:
A BRIEF STUDY OF THE FOLLOWING WITH SPECIAL REFERENCE TO THE MAIN PROVISIONS.
a) Medicinal & Toilet preparations (Excise duties Act 1955) - relevant to drug and pharmaceuticals.
b) Poisons Act 1919.
e) A.I.C.T.E. Act 1987. (08)

UNIT-V:
b) U.S Food and Federal D&C Act – CFR -21, CGMP; EuGMP,WHO,Orange book
(08) Note: The teaching of all the above Acts should cover the latest amendments.

BOOKS RECOMMENDED:
1. CK Kokate, Text Book of Forensic pharmacy, PharmaMed Press
2. Mittal B.M, Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
3. Relevant Acts & Rules Published by the Govt. of India.
6. Relevant websites.
B.Pharm 3rd year (V Semester)

PHR-501

PHARMACEUTICAL CHEMISTRY- V (BIOCHEMISTRY)

Unit-I:


b. **Co-enzymes**: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance. [08]

Unit-II

a. **Carbohydrate metabolism**: Glycolysis, Gluconeogenesis and Glycogenolysis. Metabolism of galactose. [08]

Unit-III

a. The role of sugar nucleotides in biosynthesis and pentose phosphate pathway.

b. The citric acid cycle, significance, reactions and energetics of the cycle. [08]

Unit-IV

a. **Lipid metabolism**: Oxidation of fatty acid & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, regulation of lipid metabolism, essential fatty acids.

b. **Biological Oxidation**: The respiratory chain, its role in energy capture & control, energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation. [08]

Unit-V

a. **Protein metabolism**: Biosynthesis of amino acids, metabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine, formation of deoxyribonucleotides.

b. Biosynthesis of RNA, DNA replication, Biochemical aspects of Carcinogensis & DNA repair mechanism. [08]

PHARM 501P

PHARMACEUTICAL CHEMISTRY- V (BIOCHEMISTRY) PRACTICAL

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
4. Separation of lipids by TLC.
6. 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:

5. Moore, Biochemistry and physiology of plants,
PHR-502
PHARMACEUTICS
(PHARMACEUTICAL TECHNOLOGY -I)

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

Unit-II: Liquid Dosage Forms: Introduction, types of permissible additives, formulation, manufacturing, evaluation and packaging of clear liquids, suspensions permissible and emulsions. [08]

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

Unit-IV: Suppositories: Ideal requirements, bases, manufacturing procedure, evaluation and packaging [08]

Unit-V:
Pharmaceutical Aerosols: Definition, Propellants, general formulation and evaluation, manufacturing and packaging methods, pharmaceutical applications.

Cosmetology and cosmetic Preparations: Formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, sunscreen lotion, antiperspirants, deodorant. Shampoos, Conditioner, Shaving and after shaving products, Dentifrice Lipstick, Nail lacquer. [08]

PHR-502P
PHARMACEUTICS
(PHARMACEUTICAL TECHNOLOGY-I)

PRACTICAL

1. Preformulation studies of API. (As per pharmacopoeial requirements)
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.

BOOKS RECOMMENDED
5. Harrys Cosmetology
10. Drugs and Cosmetics Act and Rules
11. Poucher “Cosmetics”.pharmamed press,hyderabad
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. [08]

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic and assay procedures of individually mentioned drugs only) included in the latest edition of pharmacopoeia.

Unit-II: Drugs acting at Synaptic and neuro-effector junction sites:
Cholinergic, Anticholinergic & Anticholinesterases- Neostigmine, Physostigmine, Pilocarpine, Atropine. Adrenergic Drugs- Ephedrine, Salbutamol, Adrenaline. [08]

Unit-III: Drugs acting on the Central Nervous System: [08]
General Anaesthetics-Thiopental, Ketamine
Local Anaesthetics- Lignocaine, Benzocaine.
Sedatives and Hypnotics- Phenobarbitone, Alprazolam.
Opioid Analgesics-Pethidine, Methadone, Pentazocine.

Unit-IV: [08]
Anticonvulsants-Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.
Antiparkinsonism drugs- Carbidopa, Levodopa.
CNS Stimulants-Caffeine, Nikethamide.

Unit-V: Psychopharmacological Agents: [08]
Antianxiety drugs- Diazepam, chlor Diazepoxide.
Antidepressants – Imipramine, Amitriptyline Fluoxetine.
Skeletal muscle Relaxants– Gallamine Mephenesin, Antipsychotic- Chlorpromazine, Haloperidol.

PHR -503P
PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY-I)

PRACTICAL

1. Synthesis of at least five drugs from the course content involving two or more steps. eg Benzocaine, Phenytoin, Barbituric acid, Nikethamide etc
2. Establishing the pharmacopoeial standards of the drugs synthesized.

BOOKS RECOMMENDED:
7. Vardanayan R. Synthesis of Essential Drugs, Academic press an imprint of sElsevier
8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint of Elsevier
9. Pharmacopoeia of India, Ministry of Health, Govt. of India 2010
Unit-I: General Pharmacology – Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug action. [07]

Unit-II: Basic Concepts of Pharmacokinetics- Absorption, Distribution, Metabolism, Excretion Pharmacodynamics ,Principles of drug action ,Mechanism of drug action , Receptors, Dose Response curve,Therapeutics index -LD 50 & ED50,. [07]

Unit-III: Pharmacology of ANS
Drug acting on autonomic nervous system
I-Cholinergic system-
Parasympathomimetic (Cholinergic ) drugs.
Parasympatholytic (anti Cholinergic) drugs.
Drug acting on autonomic ganglia (Stimulants and blocking agents)

II-Adrenergic system
Sympathomimetic (Adrenergic) drugs
Sympatholytic (Anti-adrenergic) drugs [08]

Unit-IV: Pharmacology of CNS
General Anaesthetics, Alcohols & disulfiram, Sedative hypnotics,
Psychopharmacological agents-anti anxiety agents, antipsychotics, antidepressants. Antiepileptic drugs, Antiparkinsonism drugs, Analgesics & antagonists. [12]

Unit-V: Drugs acting on PNS
Local anesthetics [06]
Skeletal muscle Relaxants Peripherally and centrally acting muscle Relaxants

PHR-504P

PHARMACOLOGY- I

PRACTICAL

Use of computer simulated CDs or Video cassettes for pharmacology practical where possible.
2. Study of different routes of administration of drugs in mice/rats. Practical related to DRC

BOOKS RECOMMENDED:
10. Turner, Screening Methods in pharmacology, Elsiver
PHR-505
PHARMACEUTICAL MICROBIOLOGY

Unit-I:
Introduction to the scope of microbiology and microscopy
Structure of bacterial cell.
Classification of microbes and their taxonomy: Bacteria, fungi and viruses. [08]

Unit-II:
Identification of Microbes: Stains and types of staining techniques.
Nutrition, cultivation, isolation and purification of bacteria, fungi & viruses.
Different culture media and their classification-
Microbial growth and their curve, measurement of microbial growth, factor influencing
Microbial growth [08]

Unit-III:
Control of microbes by physical and chemical methods.
Disinfection, factors influencing disinfectants, dynamics of disinfection,
Disinfectants and antiseptics and their evaluation.
Preservative efficacy [08]

Unit-IV:
Sterilization, different methods, validation of sterilization methods & equipments.
Sterility testing as per I.P. Isolation and identification of contaminants in sterile and non-sterile
Products, Microbiological standards of non-sterile products, Equilibrium related to humidity
(ERH) in microbiological testing. [08]

Unit-V:
Microbial assays as per I.P. of antibiotics and vitamins. [08]

PHR-505P
PHARMACEUTICAL MICROBIOLOGY
PRACTICAL

1. Various staining methods, 2. Experiments designed to prepare various types of culture media
sub-culturing of common aerobic and anaerobic bacteria, fungus and yeast, 3. Various methods
of isolation and identification of microbes 4. Sterilization techniques and their validation, validation
of sterilization techniques 5. Evaluation of antiseptics and disinfectants 6. Testing the sterility of
pharmaceutical products as per I.P. requirements, 7. Microbial assay of antibiotics and vitamins,
8. preservative efficacy, 9. Microbiological testing of non-sterile products.

BOOKS RECOMMENDED:
3. Tortora, Microbiology An Introduction, 9th Ed, Pearson education
5. Pelczar & Reid, Microbiology, Tata Mc Graw Hill, Delhi.
7. Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture &
Mushroom Cultivation, Vishwa Prakashan.
9. Latest edition of USP
10. Latest edition of IP
11. Latest edition of B.P.
**B.Pharm 3rd year (VI Semester)**

**PHR –601**

**PHARMACEUTICAL BIOTECHNOLOGY**

**Unit-I: Immunology and Immunological preparations:**
Principles, Antigen and haptens, immune system, Cellular, and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG. Complementary system, Immunological disorder, Hypersensitivity reaction, Immunosuppression, Autoimmune disorders, immunodeficiency disorders [08]

**Unit-II: Genetic Recombination**
Genetic Code and inhibition of protein synthesis. Regulation of gene expression (Prokaryote and Eukaryote)
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 Human Insulin, Somatotropin, Streptokinase, Urokinase. Isolation and uses of mutants and factors affecting mutation and genetic analysis of mutants [08]

**Unit-III: Microbial Transformation:**
Introduction, types of reactions mediated by microorganisms, Design of Bio-transformation process, selection of organisms, biotransformation processes and its improvements with special reference to steroids [08]

**Unit-IV: Enzyme immobilization:**
Techniques of immobilization of enzymes, factors affecting enzyme kinetics, multistep immobilized enzyme system. Application and future of enzyme engineering [08]

**Unit-V: Antibiotics:**
Historical development of antibiotics, Screening of soil for organisms producing antibiotics Antimicrobial spectrum and methods used for their standardization. Fermentor, its design and control of different parameters [08]

**BOOKS RECOMMENDED:**
5. Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)
PHR-602

PHARMACEUTICS-VII
(PHARMACEUTICAL TECHNOLOGY - II)

Unit-I: Tablets: (A) Formulation of different types of tablets, granulation technology on largescale by various techniques, physics of tablets making, machinery and tooling and the equipments employed, evaluation of tablets including stability testing as per ICH guidelines

(B) Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet. [09]

Unit-II: 1. Capsules: Introduction to capsules as a dosage form, hard and soft gelatin capsules, formulation and evaluation, machinery, packaging, stability testing and storage

2. Micro-encapsulation: Types of microcapsule, importance of micro-encapsulation in pharmacy, micro-encapsulation techniques, evaluation of micro capsules. [8]

Unit-III: (A) Approaches to Sustained and controlled release dosage forms. In-vitro methods of evaluation. [08]

Unit-IV: Parenteral Products:
Preformation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation and evaluation, equipments, containers and closures and their selection. [07]

Unit-V:
(A) Sterile products (ISI/ BS specification)
(B) Formulation and evaluation of Ophthalmic, Nasal and Ear products. [08]

PHR-602P

PHARMACEUTICS-VII
(PHARMACEUTICAL TECHNOLOGY - II)

PRACTICAL

1. Experiments to illustrate preparation, stabilization and evaluation of pharmaceutical products as per the theory syllabus
2. Evaluation of Materials used in pharmaceutical packaging (ISI/ BS specification)

BOOKS RECOMMENDED

3. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lippincott William Wilkins
4. Herbert A. Liebermann & Leon Lachman, Theory & Practice of Industrial Pharmacy,
5. Manohar A.Potdar,’ CGMP for Pharmaceuticals”.PharmaMed Press,Hyderabad
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)
10. Tutorial Pharmacy by Cooper and Gunn, CBS Publisher do
11. Senger, A primer on dosage form design, PharmaMed Press, Hyd,
Unit-I: Drug Design
Basic concept of drug design, Introduction to Analogues based drug design, Structure based drug design, and Introduction to QSAR & Computer aided drug design. [08]

Unit-II: Mode of action, uses, SAR of the following classes of drugs included in latest edition of pharmacopoeia (synthetic procedures and assay of individually mentioned drugs only)
Cardiac glycosides & drug used for CHF- Digitoxin
Antiarrhythmic drugs- Propranolol, Procainamide
Antianginal drugs- Isosorbide mononitrate
Antihypertensive drugs-Captopril, methyldopa, Nifedipine.
[08] Anticoagulants- Heparin, warfarin
Antihyperlipidemics- Lovastatin, Clofibrate

Unit-III
Antispasmodic and Antiulcer drugs- Dicyclomine, Ranitidine, Omeprazole.
Antitussives- Dextromethorphen.
[08]

Unit-IV: Analgesics and Antipyretics – Aspirin, Mefanamic Acid, Ibuprofen, Diclofenac, Paracetamol [08]

Unit-V: Diuretics – Acetazolamide, Chlorthiazide; Furosemide, Spironolactone. [08]

BOOKS RECOMMENDED:
4. Shri ram., Yogeeswari, medicinal chemistry, 2nd Ed, Pearson education
6. Korolkovas, Essentials of medicinal chemistry, Wiley India
7. 8. Wermuth C G. The practice of Medicinal Chemistry-III, Acaedmic press an imprint of Elsevier
9. Pharmacopoeia of India 2010, Ministry of Health, Govt. of India.
12. Latest edition of B.P.
Unit-I:
**Pharmacology of CVS:** Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics [09]

Unit-II:
**Drugs Acting on Haemopoietic System**
Haematinics, Vit. K & anticoagulants, Fibrinolytics & antiplatelet drugs, Plasma Volume expanders

**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, Thromboxane, Leukotrienes, Angiotensin and Bradykinin [08]

Unit-V: **Drugs acting on GIT**
Antacids and Antulcer drugs, Laxatives and anti diarrhoeal Agents, Emetics and antiemetics [07]

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**PHR-604P**

**PHARMACOLOGY-II**

**PRACTICAL**

1. Relevant experiments based on theory syllabus

**BOOKS RECOMMENDED:**

3. Laurence, DR & Bannet PN; Clinical Pharmacology, Churchill Livingstone.
4. Rang MP, Date MM, Riter JM, Pharmacology Churchill Livingstone.
8. Turner, Screening methods in pharamacology, PharmaMed Press, Hyderabad
Unit-I: (A) Study of the biological sources, Commercial varieties cultivation, collection adulterants, uses, diagnostic macroscopic and microscopic features and chemical constituents, substitutes and specific chemical tests of following groups of drugs containing.

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

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

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

**Unit-III: Studies on 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, Bhilwa, Vach, Rasna. [08]

**Unit-IV:** Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Tulsi and Neem. [08]

**Unit-V:** Brief Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia, study of Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. [08]

**PHR-605 P**

**PHARMACOGNOSY - III**

**PRACTICAL 11**

1. Identification of atleast 10 crude drugs mentioned in theory
2. Powder microscopic study of atleast 5 drugs
3. Evaluation and standardization of atleast 3 marketed Ayurvedic formulations

**BOOKS RECOMMENDED:**
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. Kokate CK, Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan
12. Indian Pharmacopoeia.
15. Harborne J.B.- “Phytochemical methods” Springer International
16. WHO guidelines
17. BP (Latest edition)
18. Standard botanicals by P. Mukharejee