Syllabus for the conduct of screening test for the post of laboratory Assistant in Pharmaceutical Sciences

Unit 1

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES

1. Chromatographic techniques - Principles of separation and applications of TLC, Column chromatography, Paper chromatography, Ion exchange chromatography, G.C, HPTLC , HPLC and electrophoresis. , Th

2. Infrared spectroscopy - Introduction, basic theory, modes of vibration, instrumentation e Hook's Law & calculations of frequencies for different types of bonds, coupled interactions, hydrogen bonding radiation source, sample handling, applications of IR spectroscopy and introduction about FT-IR.

3.Ultraviolet spectroscopy – Introduction, electronic transitions, the origin and designation of UV band, absorption laws, calculation of Lambda maxim, the chromophore concept, factors effecting the position of UV bands, instrumentation, qualitative and quantitative applications.

4. Nuclear Magnetic Resonance spectroscopy – A. 1H NMR Spectroscopy - Introduction, principle, instrumentation, solvents, chemical shift, spin-spin coupling, coupling constant, spin-spin splitting, chemical equivalence, Pascal triangle. Application including interpretation of Proton-NMR spectra. B. 13C NMR Spectroscopy – Introduction, peak assignments, off resonance decoupling, selective proton decoupling, chemical shifts and factors affecting them, chemical shift equivalence, and spin coupling. Applications of 13C NMR.

5. Mass Spectrometry - Basic principle and theory involved, Instrumentation, types of ions, fragmentation, rearrangements, recognition of molecular ion peak, mass spectra of representative compounds, chemical ionization mass spectrometry (CIMS), field ionisation mass spectrometry (FIMS), fast atom bombardment mass spectrometry (F MS). Applications.

6. Thermal analysis - Introduction to various thermal methods of analysis, basic principle and theory, Different types of calorimeters and micro calorimeters differential thermal analysis (DTA), differential scanning calorimetry (DSC) and micro calorimetry.

7. Pharmacological evaluation of drugs in biological fluids: Bioassay.

8. Microbiological assays.

9. Radioimmunoassays.

10.Quantitative microscopy of herbal drugs. Lycopodium spore method, stomatal number, stomatal index, palisade ratio, vein-islet number, and vein-termination number.

Unit 2

AROMATIC COMPOUNDS: Structure and resonance of benzene, aromatic character, mechanism of electrophilic aromatic substitution, Orientation effects in electrophilic substitution, nucleophilic aromatic substitution.
Preparation, properties and actions of: Phenols, Sulphonic acid and derivatives, Carboxylic acids, Carboxamides, Nitro compounds, amines, diazonium salts, aryl halides and ketones.
Poly nuclear aromatic hydrocarbons: Naphthalene, Phenanthrene and Anthracene.
Heterocyclic compounds: Study of fundamentals of heterocyclics,

STEROIDS: Nomenclature, Stereochemistry, Classification, Isolation methods, Chemistry of Cholesterol (Excluding Synthesis), Diosgenin, Stigmastrol and Erogsterol.

CARDIAC GLYCOSIDES: Digoxin, Digitoxin
CORONARY DILATERS: Glyceryl trinitrate, lsosorbide dinitrate, Dipyridamole,
ANTILIPIDIMIC AGENTS: Theofibrate, Clifbrate, Probucol, Gemfibrozil, Lovastatin.
ANTI FIBRILLATORY AGENTS: Quinidine SO4
ANTIARRYTHMIC AGENTS: Procainamide, Mexiletine, Flecainide, amiodarone, Verapamil.
HYPOTENSIVE AGENTS: Methyl dopa, Clomidine, Guanidine, Propranelol, Minoxidil, Nitroprusside, Reserpine, Captopril, Nifidipine.
Classification, Structure and uses:

Antibiotics: Penicillin
Aminoglycosides Streptomycin, Gentamycin, Neomycin, Kanamycin, Chloramphenicol, Tetracyclines, Cephalosporines
Antimalarials: Chloroquine phosphate Hcl; Pamaquine, Primaquine, Pentaquine phosphate, Mepacrine Hcl, Proguanil Hcl, Pyrimethamine, Trimethoprim, Quinine sulphate.
Antiaemobic: Metronidazole, Diloxanide furcate, Paramomy cin, Phanquone.
Anthelminthes: Albendazole, Mebendazole, Praziquintal, Piperazine citrate.
Antifungal agents: Propionic acid, Ketoconazole, Griseofulvin, Natamycin.
Anti-Tubercular Drugs: P-Amino salicylic acid, Isomiazide, Pyrazinamide, Ethanbutol, Ethinoamide.
Medicinal Dyes: Crystal Violet, Brilliant green, Acriflavin, Methylene blue, Malachite green.
Anti-Viral agents: Amantidine Hcl, Idoxuolidine, Acycloviv, Vidabarin, Ribavarin, Methisazone.
Antineoplastic: Mechlorethamine Hcl, Mephalan, Cholrambucil, Buslfan, Triethylene, Melanine, Carmustine, Methotrextrate, Mercaptoparin, Flururacil, Cytrabin Azaserine, Daunorcrbicin, Cisplatin Mitotane.

Anticonvulsants: Phenobarbitone, Phenytoin, Trimethadion, Paramethadion, Phensuxlmide, Valproic acid, Primadone, Crbama epine.
Antihistaminics: Diphenyhydramine, lamotrigene, Dime4nhydrenate, Pyrilamine malaete, Triaplenenamine rrialeate, Pheniramine maleate, Promethazine,

Antiparkinsonism drugs: Bipridine, Trihexyphenidyl, Procyclidine, Thopropazine, Orphenadrine citrate, Levodopa, Amantidine.
Diuretics: Chloroeneowrin, Mercaptomerine, Chlorothiozaide, Bendroflumethiazide, Polythiazide, Acetazolamide, Disulfamide, Chlorothalidone, Furosemide, Ethacrynic acid, Spirmolactone, Triamterene.
Non-steroidal anti-inflammatory agents: Indomethacin, Tolmetin, Ibuprofen, Diclifenac, Ketoprofen, Naproxen, Auranofin, aspirin, Phenylbutazone
Expectorants & antitussives: Acetylcycsteine, Bromohexine, Ammonium chloride, Guaniphesine, Eucalyptol, Benzonatate, Nocapine, Genopropoxyphene,

hypoglycaemic agents: Insulin, Tolbutamide, Chlopropamide, Glibenclamide, Glipizide, Phentormine, Piglitazone
Antipyretic analgesics Paracetamol, Acetanalide, salicylamide, Benorylate phenozone Dipyrone, Mefananine acid
Uricosurics (Anti-gout Agents): Probenecid, Sulfinpyrazone, allopurinol, Colchicine, Prednisolone
Muscle relaxants Chlorzoxazone, Paclofen, Crisoproder, Mephencsin, Dantrollene 11.
Adregenic drugs: Adrenaline, Noradrenaline, Terdutaline, Amphetamine, Ephedrine, Isoprenaline
Cholinergics: Acetylcholine, Pilocarpine, Carbachol, Edrophonium, Physostigmine, anticholinepsterases
Antispasmodics: Homatropine, Diperidine Hcl, Dicyclolomine, Orphemnadrine citrate,
psychoactive drugs: Triflupromazine, Haloperidul, Diazepam, Oxazepam, Alprozolam, Amitryptiline, Imipramine, Fluoxetive, Venlafaxine, Phenelzine, Tranylcypromine

Unit 3

Acid base titration: Theories of acidimetry and alkalimetry, classification, direct titration of strong acids, strong bases, preparation and standardization of acids and bases, official assay procedures e.g. boric acid, hydrochloric acid, sodium hydroxide, Zinc oxide, Sodium carbonate, tartaric acid, aspirin
Redox reaction: Redox indicators, Potassium permanganate titrations, lodometry and lodimetry, Cerric ammounium sulphate titrations, Potassium iodate titrations Preparation and standardization of titrants like Silver nitrate, Ammonium thiocynate titrations according to Mohr's and Volhard's methods
Diazotization: Different conditions involved in diazotisation of different amines, end point determination, Pharmaceutical analytical applications
Gravimetric analysis: Introduction, precipitation, techniques, supersaturation, coprecipitation, digestion, washing of precipitates, filtration, filter paper and crucibles, ignition
Non-aqueous titrations: Acid-base equilibria; in non aqueous media, titration of weak bases, titration of weak acids
Complexometric titrations: Types, metal ion indicators, factors influencing the stability of complexes and applications e.g. Calcium gluconate, Bismuth carbonate, Potassium alum

Potentiometric analysis: Potentials of Galvanic cells, Potentiometric acid-base titrations, Potentiometric pH determination, precipitation and complex formation, Oxidation-reduction titrations, applications in Pharmacy.
Conductometric analysis: units in conductometric titrations, determination of water analysis of salt solutions, measurement of conductance, high frequency (Oscillometric method), applications.
Aquametry: Physical methods for water determination, thermal methods, azeotropic distillation, refractive index, spectrophotometric method, gas chromatography, electrochemical methods, chemical methods of water determination, Karl Fischer method of moisture determination.
Polarimetry: Its principles and applications; polarization types of molecule analysed; optical rotation; effects of concentration, wave length, solvent, temperature on optical rotation; polarimeter, light source, sample cells.

Introduction, Occurrence, Isolation, classification, general methods of determining structure with reference to Citral, Citronallol, Carvone Limonene, Thymol, Menthol and structural features of terpenoids (isoperene rule).

Alkaloids: Introduction, Occurrence, functions of Alkaloids. Classification, isolation, properties. General methods of determining structure of alkalods with reference to Ephedrine, Atropine, Quinine, Papaverine and Morphine.

Glycosides: Introduction, Natural glycosides, Classification and methods of isolation and determination of structure, Arbutin, Salicin, Amygdalin, Sinigrin and Indican.

Carbohydrates: Introduction, Nomenclature and Classification. General reactions of Monosaccharides, Configuration of Monosaccharides, Structure and properties of disaccharides, Maltose, Lactose and Sucrose. Structure and properties of Polysaccharides: Starch, Glycogen and Cellulose. Structure and conformation of Sugars. Isomerism in sugars. Mucopolysaccharides.

Lipids: Introduction, Classification of lipids. Fatty acids- Nomenclature and Physio-chemical properties. Phospholipids- Their properties and functions. Glyco lipids and Sphingo lipids. Lipo proteins.

Amino acids and proteins: Introduction, Classification of amino acids. General physical and chemical properties of amino acids. Polypeptides- Synthesis of polypeptides. Proteins and uses of proteins. Classification and structure of proteins

Purines: Introduction, Synthesis and Classification of Purines. Methods of determining structure with reference to Caffeine, Theobromine and Theophylline.

Flavones and Iso-flavones: A preliminary study

Unit 4

Surface and Interfacial Phenomenon: Determination of surface and interfacial tension, surface free energy, spreading co-efficient, adsorption isotherms, factors affecting adsorption and applications of adsorption, General characters and classification of surfactants, HLB, solubilization: Mechanism, factors and application of solubilization, Micelle formation, CMC, Detergency, Wetting agents, Contact angle, Foaming and Antifoaming agents..

Complexation: Protein binding Metal complexes, molecular organic complexes, inclusion complexes, method of analysis, protein binding, factors and its applications

Drug stability: Mechanisms of drug degradation, Influence of light and temperature on drug decomposition. Chemical stability testing in dosage forms and storage

Reaction kinetics: Molecularity of reactions, order of reaction, determination of order, factors affecting rate of reaction, accelerated stability analysis.

Viscosity and Rheology: Viscosity, factors affecting viscosity, Determination of flow properties, Viscoelasticity, Newtonian and Non-newtonian systems, thixotropy, Thixotropy measurement and applications. Rheopexy, negative thixotropy

Size Reduction and Size Separation Definitions, factors affecting size reduction; Principles, Laws and factors affecting energy requirements, different methods of size reduction, study of Hammer mill, Fluid energy mill and disintegrator. Various methods & equipments employed for size separation e.g. sieving, sedimentation, centrifugal, elutriation, microscopic methods

Prescriptions: Modern Methods of prescribing Common Latin abbreviations,

Alcohol dilutions, use of Alligation methods; proof spirit. Isotonic solutions,

Suppositories: Displacement value of suppositories

Posology: Dose and dosage of drugs, Factors influencing dose. Calculations of doses on the basis of age, sex and surface area, Percentage calculations %, w/v, v/v & w/w.

Powders: Types; merits and demerits; Compounding, storage and packaging of: Effervescent powders, Granules, Cachets and tablet triturates, Dusting powders.

Liquids Dosage Forms: Preparation, merits, demerits, storage and packaging of solutions and mixtures of Pharmaceuticals

Emulsions: Preparation, identification uses, Classification of emulsifying agents and stability of Emulsions.

Suspensions: Preparation of suspensions, suspending agents; Flocculated and Deflocculated suspensions; stability of suspensions.

Semi-Solid Dosage Forms: Ointment bases: dispensing, demerits and packaging aspects of ointments, pastes, jellies, Poultice, Suppositories and Pessaries.

Sterile Dosage Forms: Definition, types, their merits and demerits, Elementary study of the formulation characteristics of the following types: Injectable preparations, Ophthalmic and ENT products, Total Parenteral nutrition, Dialysis fluid

Preformulation studies: Solid state properties (Crystallinity, Polymorphism), Solubility studies (Dissociation, Partition coefficient, pH solubility profile, common ion effect) Stability study and Drug Excipient interaction

Tablets: Production of tablets, additives and components for compression, forms of compressed tablets, evaluation. Tablet coating: Sugar coating, film coating, air suspension coating, film defects.

Capsules: Hard gelatin capsules: formulation of shell & contents, capsule production, filling operation and equipment employed. Soft gelatin capsules: Manufacture, processing and quality control.

Microencapsulation: Importance and Application, techniques, equipment employed.

Pharmaceutical Aerosols: Components, formulation, types of systems, manufacturing, operation of an aerosol package , quality control and testing, oral, inhalation, nasal and topical aerosols, future developments.

Controlled Drug Delivery systems: Introduction, terminology, Drug targeting, Design and fabrication of oral controlled release drug delivery system. Introduction to implantable and transdermal therapeutic system.

Sustained action dosage form: Drug replacement rate, unit drug dose, mechanisms, formulation and manufacture of sustained action dosage form.

Packaging technology: Types of containers; materials used, closures, unit dose packaging, strip packaging materials, packaging of solid, parenterals and Ophthalmic dosage forms.

Biopharmaceutics: Fundamental principles and concepts, Bioavailability, Bioequivalence and inequivalence, Chemical equivalence, therapeutic equivalence etc.

Drug Absorption: Mechanisms, physio-chemical, biological and dosage form considerations in in gastrointestinal drug absorption.

Drug disposition: Distribution in blood, plasma-protein binding, cellular distribution, drug penetration to cell, drug excretion -renal, biliary, salivary and biotransformation.

Bioavailability: Introduction, comparative bioavailability, Methods of estimation of bioavailability

Pharmacokinetics: Introduction, importance in bioavailability and clinical practice and concepts,Terminologies used.

Absorption, distribution, metabolism and excretion of drugs. Biological halflife, apparent volume of distribution, Fluid compartments and circulatory system.

Unit 5

Definition, scope and branches of Pharmacology, Routes of drug administration and drug delivery systems, bioavailability and biotransformations, metabolizing enzymes as targets of drug action (induction and inhibition), Mechanisms of drug action, drug receptors and cellular signaling systems, Drug antagonism and synergism, Drug dependence and related conditions, Pharmacovigilance, Adverse Drug Effects and their monitoring, Iatrogenic Diseases, Pharmacogenetics and Pharmacoeconomics

ANS: Cholinergic receptors, cholinergic drugs (Parasympathomimetics, anticholinesterases), anticholinergic drugs. Adrenoceptors, sympathomimetics, adrenoceptor blockers and adrenergic neurone antagonists
Drug action on autonomic ganglia (ganglionic stimulants, ganglion blocking agents).
Neuromuscular blocking agents and centrally acting muscle relaxants
Autocoids: Histamine, Antihistaminics
Serotonin, agonists and antagonists
Arachidonic acid metabolites
Angiotensin, Plasmakinins, VIP, neurotensin, Substance P, PAF

CNS: Synaptic transmission in CNS, General Anesthesia, Hypnotic and Sedatives, Alcohol, Anti-convulsants, Psychopharmacological agents, Antipsychotics, Anxiolytics, Antidepressants, Antiparkinsonian drugs, Non-steroidal Analgesics, anti-inflammatory and anti-pyretic agents, drugs used in gout, DMARDs.

Drugs acting on cardiovascular system

Cardiac glycosides and inotropic agents used in CHF, Anti-arrhythmic agents, Anti-hypertensive agents, Coronary vasodilators and drugs used in angina, Hypolipedimic drugs., Fibrinolytic agents.

Chemotherapy: General principles of Chemotherapy, Sulfonamides, Quinolones, aminoglycosides, tetracyclines, penicillines, cephalosporins and macrolide antibiotics, Antiprotozoal drugs, Antimalarials, Antiamoebics, Antifungal and antiviral drugs, Anti-helmintics, Chemotherapy of Tuberculosis and leprosy.
Chemotherapy of cancer, Immunomodulators
Pharmacology of endocrine system: Pituitary hormones, Thyroid, antithyroid drugs, Insulin, Oral hypoglycemics and glucagons, Adrenocortical steroids and their antagonists Sex hormones, contraceptives and drugs used in fertility, Drugs regulating calcium homeostasis.
Drugs acting on the blood and blood forming agents: Coagulants, Anticoagulants, Hametinics (Iron, vitamin B2 and Follic acid), Plasma Expanders.
Diuretics
Drugs acting on gastrointestinal system: Purgatives, Antidiarrhoeal drugs, Antiacids and antiemetics, Digestants
Drugs acting on respiratory system: Expectorants, Antitussives. Drugs used for cough and bronchial asthma
Bioassays: General principles and methods of Bioassays, Official methods of bioassay: Insulin, Heparin, Oxytocin, d-Tubocurarine, Vasopressin, Digitalis, ACTH, Glucagon, Gonadotrophin. Evaluation of new drugs: Acute, subacute and chronic toxicity tests,

Teratogenicity & Carcinogenicity, Clinical trials.
Vitamins

Unit 6

Hospital Pharmacy: Functions and objectives, Location, Layout & flow chart of material and men, personnel and facilities required, including equipments.
Drug distribution system in Hospitals; a) Out patients b) In patients: Detailed discussion of; i) Unit dose dispensing ii) Floor ward stock system & satellite pharmacy services. iii) Central sterile services; bed side pharmacy. iv) Prepackaging
Maintenance of records of issue and use of Nacrotics and Dangerous drugs, Ward stock medicines and emergency drugs.
Medical stores: Medical store management, Organization of Drug store, Location and layout, Inventory and stock control, Procedures for procurement of drugs and supplies from different sources. Inspection and issue of material. Storage of materialsf Non-parenterals, Parenterals) , Pricing policy, Utilization of computers in drug store management. Maintenance of records of retail and wholesale., Pharmacy Therapeutics Committee: Constitution and functions of Pharmacy therapeutics committee, Hospital formulary system and their organization, Functions and composition,
Nomenclature and uses of surgical instruments, hospital equipments and health accessories.
Rational Drug Use & Essential Medicines- drug interactions, adverse reactions
Clinical Toxicology: Poisoning management, antidotes, heavy metal toxicity, Mutagenicity, Teratogenicity and Carcinogenicity
Spread and prevention of communicable diseases- AIDS, sexually transmitted diseases, small pox, measles, influenza, diphtheria, ` whooping cough, meningitis, tuberculosis, polio-myelites, viral hepatitis, cholera, typhoid, diarrhoea, amoebiasis, malaria, filariasis, rabies, tetanus, leprosy.
Contraception (mechanical, chemical, surgical, immunological, physical and physiological)
Immunization- vaccines, toxoids and their uses
Therapeutic Drug Monitoring- importance, high-risk drugs
Structure, function and properties of genetic material, Basic principles of genetic engineering, Blood products, Synthesis of monoclonal antibodies, biopolymers, derivative of biopolymers and their application in medicine
Enzyme & Cell immobilization-Methods and applications, Plant cell culture for the production of useful chemicals, plant tissue culture, protoplast fusion, totipotency, direct gene transfer

Unit 7

Introduction to different group of plant constituents and their tests.
Different systems of medicine practiced in India with specific reference to Unani, Ayurvedic and Homoeopathic medicines
Natural pesticides and insecticides.
Classification and chemistry of carbohydrates.
Study of drugs dealing with biological sources, geographical distribution, collection, chemical constituents, chemical tests for identity, substitutes, adulterants and uses of following drugs; Starches, Acacia, Tragacanth, Sterculia, Guargum, Plantago and Honey
Study of Lipids, their chemistry, classification and biogenesis of lipid containing drugs
Biological source, chemical constituents, tests for identity and use of the following; Arachis oil, Castor oil, Sesame oil, Cotton seed oil, Olive oil, Chaul moogra oil, Bees wax
Drugs of animal origin: Shellac, Cochineal, Cantharides, Spermaceti, Wool fat.

Tannin containing drugs: Catechu (Black and pale), Tannic acid, Myrobalon,
General study of formation of secondary metabolites. Biogenesis of primary metabolites and importance of photosynthesis in formation of primary metabolites and their relationship to the formation of secondary metabolites (Calvine cycle , TCA cycle, Shikimic acid pathway, Embden Merrhoffs pathway, Acetate hypothesis, Isoprenoid compounds biosynthesis
Study of drugs containing alkaloids: Nature, occurrence, Chemistry and Biosynthesis.
Tropane alkaloids: Belladona, Hyoscymus, Stramonium, Duboisia.
Quinoline alkaloids: Cinchona
Isoquinoline alkaloids: Opium, Ipecac.
Indole alkaloids: Nuxvomica, Ergot, Rauwolfia, Catharanthus
Steroidal alkaloids: Kurchi, Solanum. Dioscorrea
Alkaloidal Amines: Ephedra, Colchicum
Methods of plant extraction and chromatographic techniques as applicable to Phtopharmaceuticals.
Study of volatile oil containing following drugs with regard to the nature, occurrence, chemistry, biogenesis and Pharmacognostic study of turpentine, Mentha, Cardamom Cinnamon, Lemon grass, Caraway, Dill, spearmint, Clove, Star anise, Fennel,
Factors affecting formation of plant drug constituents, Drug adulteration and authentication. Evaluation of crude drugs
Plant tissue culture techniques and their contribution to phytopharmaceuticals.
Plant growth regulators

Unit 8

Historical background: Drug Legislation in India, Code of Ethics for Pharmacists, Drug Laws:
a) Prevention of Cruelty Against Animals Act,
b) Pharmacy Act-1948,
c) Drugs and Cosmetic Act-1940, Rules 1945,
d) Narcotic Drugs and Psychotropic Substance Act, and Rules thereunder,
e) Drugs and Magic Remedies (Objectionable Advertisements) Act 1954,
f) Medicinal and Toilet preparations (Excise duties) Act-1955, Rules-1976,
g) Poisons Act,
i) Indian Patents Act, 1970 with recent amendments,
j) The Drug (prices control) order, 1995,
j) The Insecticides Act,
k) Prevention of Food Adulteration, Act and Rules thereunder