DOCTOR OF PHARMACY

3RD YEAR

SYLLABUS

RESEARCH DOCTOR PHARMA

3.1 PHARMACOLOGY – II (THEORY)

Topic

1. **Pharmacology of Drugs acting on Blood and blood forming agents**
    a) Anticoagulants
    b) Thrombolytics and antiplatelet agents
    c) Haemopoietics and plasma expanders
2. **Pharmacology of drugs acting on Renal System**
    a) Diuretics
    b) Antidiuretics
3. **Chemotherapy**
    a) Introduction
    b) Sulfonamides and co-trimoxazole
    c) Penicillins and Cephalosporins
    d) Tetracyclins and Chloramphenicol
    e) Macrolides, Aminoglycosides, Polyene & Polypeptide antibiotics
    f) Quinolines and Fluroquinolines
    g) Antifungal antibiotics
    h) Antiviral agents
    i) Chemotherapy of tuberculosis and leprosy
    j) Chemotherapy of Malaria
    k) Chemotherapy of protozoal infections (amoebiasis, Giardiasis)
    l) Pharmacology of Anthelmintic drugs m) Chemotherapy of cancer (Neoplasms)
4. **Immunopharmacology** Pharmacology of immunosuppressant and stimulants
5. **Principles of Animal toxicology**
    Acute,
    Sub-acute
    Chronic toxicity

6. **The dynamic cell:** The structures and functions of the components of the cell

   a) Cell and macromolecules: Cellular classification, subcellular organelles, macromolecules, large macromolecular assemblies

   b) Chromosome structure: Pro and eukaryotic chromosome structures, chromatin structure, genome complexity, the flow of genetic information.

   c) DNA replication: General, bacterial and eukaryotic DNA replication.

   d) The cell cycle: Restriction point, cell cycle regulators and modifiers.

   e) Cell signaling: Communication between cells and their environment, ion-channels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and PI3-kinase pathways, biosensors.

7. **The Gene:** Genome structure and function:

   a) Gene structure: Organization and elucidation of genetic code.

   b) Gene expression: Expression systems (pro and eukaryotic), genetic elements that control gene expression (nucleosomes, histones, acetylation, HDACS, DNA binding protein families.

   c) Transcription and Transcription factors: Basic principles of transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes.

   RNA processing: rRNA, tRNA and mRNA processing. Protein synthesis: Mechanisms of protein synthesis, initiation in eukaryotes, translation control and post-translation events Altered gene functions: Mutations, deletions, amplifications, LOH, traslocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes. The gene sequencing, mapping and cloning of human disease genes. Introduction to gene therapy and targeting. Recombinant DNA technology: principles. Processes (gene transfer technology) and applications.

3.1 PHARMACOLOGY – II (PRACTICAL)

List of Experiments:

I. Study of laboratory animals and their handling
   a. Frogs
   b. Mice
   c. Rats
   d. Guinea pigs
   e. Rabbits

II. Study of physiological salt solutions used in experimental pharmacology.

III. Study of laboratory appliances used in experimental pharmacology.

IV. Study of use of anesthetics in laboratory animals.

V. To record the dose response curve of Ach using isolated ileum/rectus abdominis muscle preparation.

VI. To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by interpolation method.

VII. To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by three point method.

VIII. To record the dose response curve of Histamine using isolated guinea-pig ileum preparation.

IX. Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.

X. To carry out bioassay of Histamine using isolated guinea-pig ileum preparation by interpolation method.

XI. To carry out bioassay of Histamine using guinea-pig ileum preparation by three point method.

XII. To study the routes of administration of drugs in animals (Rats, Mice, Rabbits).

XIII. Study of theory, principle, procedure involved and interpretation of given results for the following experiments:
   a) Analgesic property of drug using analgesiometer.

b) Antiinflammatory effect of drugs using rat-paw edema method.

c) Anticonvulsant activity of drugs using maximal electroshock and pentylene tetrazole methods.

d) Antidepressant activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods.

e) Locomotor activity evaluation of drugs using actophotometer and rotorod.

f) Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

3.2 PHARMACEUTICAL ANALYSIS (THEORY)

TOPICS

1. **Quality Assurance:**

   a. Introduction, sources of quality variation, control of quality variation.

   b. Concept of statistical quality control.

   c. Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration.

   d. GLP, ISO 9000.

   e. Total quality management, quality review and documentation.

   f. ICH- international conference for harmonization-guidelines.

   g. Regulatory control.

2. **Chromatography:** Introduction, history, classification, separation techniques, choice of methods. The following techniques be discussed with relevant examples of pharmaceutical products involving principles and techniques of separation of drugs from excipients.

   a. **Column Chromatography:** Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography.

   b. **TLC:** Introduction, principle, techniques, Rf value and applications.

   c. **PC:** Introduction, principle, types of paper chromatography, preparation techniques, development techniques, applications.

   d. **Ion-exchange chromatography:** Introduction, principles, types of ion exchange synthetic resins, physical properties, factors affecting ion exchange, methodology and applications.

   e. **HPLC:** Introduction, theory, instrumentation, and applications.

f. **HPTLC:** Introduction, theory, instrumentation, and applications.

g. **Gas Chromatography:** Introduction, theory, instrumentation-carrier gases, types of columns, stationary phases in GLC & GSC. Detectors Flame ionization detectors, electron capture detector, thermal conductivity detector. Typical gas chromatogram, derivatisation techniques, programmed temperature gas chromatography, applications.

h. **Electrophoresis:** Principles of separation, equipment for paper and gel electrophoresis, and application.

i. **Gel filtration and affinity chromatography**: Introduction, technique, applications.

3. **Electrometric Methods:** Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics.

   a. **Potentiometry:** Electrical potential, electrochemical cell, reference electrodes, indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point, Karl Fischer titration.

   b. **Conductometry:** Introduction, conductivity cell, conductometric titrations and applications.

   c. **Polarography:** Instrumentation, DME, residual current, diffusion current and limiting current, polarographic wave, Ilkovic's equation, Effect of oxygen on polarographic wave, Polarographic maxima and suppressors and applications.

   d. **Amperometric Titrations**: Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and disadvantages of Amperometry over potentiometry. Pharma applications.

4. **Spectroscopy:** Theoretical aspects, instrumentation, elements of interpretation of data/spectra and application of analytical techniques be discussed on:

a. **Absorption Spectroscopy:** - Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer-Lambert's Law, application and its deviation, limitation of Beer law, application of the law to single and multiple component analysis, measurement of equilibrium constant and rate constant by spectroscopy. Spectra of isolated chromophores, auxochromes, batho-chromic shift, hypsochromic shift, hyperchromic and hypochromic effect, effect of solvent on absorption spectra, molecular structure and infrared spectra. of Instrumentation – Photometer, U.V.-Visible spectrophotometer – sources U.V.-Visible radiations, monochromators, samples cells and collimating systems, following detectors-Photocell, Barrier layer cell, Phototube, Diode array, applications of U.V.-Visible spectroscopy in pharmacy and spectrophotometric titrations. - Infrared Spectroscopy: Vibrational transitions, frequency – structure correlations, Infrared absorption bands, Instrumentation–IR spectro meter – sources of IR, Collimating systems, monochromators, sample cells, sample handling in IR spectroscopy and detectors Thermocouple, Golay Cells, Thermistor, Bolometer, Pyroelectric detector, Applications of IR in pharmacy. - Fluorimetric Analysis: Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation, Applications, fluorescent indicators, study of pharmaceutically important compounds estimated by fluorimetry.

b. **Flame Photometry:** Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.

c. **Atomic Absorption Spectrometry:** Introduction, Theory, types of electrodes, instrumentation and applications.

d. **Atomic Emission Spectroscopy:** Spectroscopic sources, atomic emission spectrometers, photographic and photoelectric detection.

e. **NMR & ESR (introduction only):** Introduction, theoretical aspects and applications.

f. **Mass Spectroscopy: (Introduction only)** – Fragmentation, types of ions produced mass spectrum and applications.

g. **Polarimetry: (Introduction only)** – Introduction to optical rotatory dispersion, circular dichroism, polarimeter.

h. **X-RAY Diffraction: (Introduction only)** – Theory, reciprocal lattice concept, diffraction patterns and applications.

i. **Thermal Analysis:** Introduction, instrumentation, applications, and DSC and DTA.

3.2 PHARMACEUTICAL ANALYSIS (PRACTICAL)

List of Experiments:

i. Separation and identification of Amino Acids by Paper Chromatography.
ii. Separation and identification of Sulpha drugs by TLC technique.
iii. Effect of pH and solvent on the UV spectrum of given compound.
iv. Comparison of the UV spectrum of a compound with that of its derivatives.
v. Determination of dissociation constant of indicators using UV-Visible spectroscopy.
vi. Conductometric titration of mixture of acids with a strong base.
vii. Potentiometric titration of a acid with a strong base.
viii. Estimation of drugs by Fluorimetric technique.
ix. Study of quenching effect in fluorimetry.
x. Colourimetric estimation of Supha drugs using BMR reagent.
xi. Simultaneous estimation of two drugs present in given formulation.
xii. Assay of Salicylic Acid by colourimetry.
xiii. Determination of Chlorides and Sulphates in Calcium gluconate by Nepheloturbidimetric Method.
xiv. Determination of Na/K by Flame Photometry.
xv. Determination of pKa using pH meter.
xvi. Determination of specific rotation.
xvii. Comparison of the IR spectrum of a compound with that of its derivatives.
xviii. Demonstration of HPLC.
xix. Demonstration of HPTLC.
xx. Demonstration of GC-MS.
xxi. Demonstration of DSC.
xxii. Interpretation of NMR spectra of any one compound.

3.3 PHARMACOTHERAPEUTICS – II (THEORY)

Topic

1. **Infectious disease:**
   - Guidelines for the rational use of antibiotics
   - surgical Prophylaxis
   - Tuberculosis
   - Meningitis
   - Respiratory tract infections
   - Gastroenteritis
   - Endocarditis
   - Septicemia
   - Urinary tract infections
   - Protozoal infection- Malaria, HIV & Opportunistic infections Fungal infections, Viral infections, Gonarrhoea and Syphillis
2. **Musculoskeletal disorders:**
   - Rheumatoid arthritis
   - Osteoarthritis
   - Gout
   - Spondylitis
   - Systemic lupus erythematous
3. **Renal system:**
   - Acute Renal Failure
   - Chronic Renal Failure
   - Renal Dialysis
   - Drug induced renal disorders
4. **Oncology:**
   - Basic principles of Cancer therapy
   - General introduction to cancer chemotherapeutic agents
   - Chemotherapy of breast cancer
   - leukemia

- Management of chemotherapy nausea and emesis

5. **Dermatology:**
   - Psoriasis
   - Scabies
   - Eczema
   - Impetigo

3.3 PHARMACOTHERAPEUTICS – II (PRACTICAL)

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation. The student shall be trained to understand the principle and practice involved in selection of drug therapy including clinical discussion. A minimum of 20 cases should be presented and recorded covering most common diseases.

3.4 PHARMACEUTICAL JURISPRUDENCE (THEORY)

Topic

I. **Pharmaceutical Legislations** – A brief review.

II. **Principle and Significance** of professional ethics. Critical study of the code of pharmaceutical ethics drafted by PCI.

III. **Drugs and Cosmetics Act,** 1940,and its rules 1945. Objectives, Legal definition, Study of Schedule's with reference to Schedule B, C&C1, D, E1, F&F1, F2, F3, FF, G, H, J, K, M, N, P, R, V, W, X, Y. Sales, Import, labeling and packaging of Drugs And Cosmetics Provisions Relating to Indigenous Systems. Constitution and Functions of DTAB,DCC,CDL. Qualification and duties –Govt. analyst and Drugs Inspector.

IV. **Pharmacy Act –1948**. Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER.

V. **Medicinal and Toilet Preparation Act –1955**. Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations.

VI. **Narcotic Drugs and Psychotropic substances Act-1985 and Rules.** Objectives, Legal Definitions, General Study, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and regulations, Schedules to the Act.

VII. **Study of Salient Features of Drugs and magic remedies Act** and its rules.

VIII. **Study of essential Commodities Act** Relevant to drugs price control Order.

IX. **Drug Price control** Order & National Drug Policy (Current).

X. **Prevention Of Cruelty to animals Act-1960**.

XI. Patents & design Act-1970.

XII. **Brief study of prescription and Non-prescription Products**.

3.5 MEDICINAL CHEMISTRY (THEORY)

TOPICS

I. **Modern concept of rational drug design:**

A brief introduction to Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules. A study of the development of the following classes of drugs including SAR, mechanism of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.

II. **Anti-infective agents**

a) Local anti-infective agents
b) Preservatives
c) Antifungal agents
d) Urinary tract anti-infectives
e) Antitubercular agents
f) Antiviral agents and Anti AIDS agents
g) Antiprotozoal agents
h) Anthelmentics
i) Antiscabies and Antipedicular agents

III. Sulphonamides and sulphones

IV. Antimalarials

V. Antibiotics

VI. Antineoplastic agents

VII. **Cardiovascular agents**

a) Antihypertensive agents
b) Antianginal agents and vasodilators
c) Antiarrhythmic agents
d) Antihyperlipidemic agents
e) Coagulants and Anticoagulants
f) Endocrine

VIII. Hypoglycemic agents

IX. Thyroid and Antithyroid agents

X. Diureties

XI. Diagnostic agents

XII. Steroidal Hormones and Adrenocorticoids

3.5 MEDICINAL CHEMISTRY (PRACTICAL)

LIST OF EXPERIMENT –

1. Assays of important drugs from the course content.
2. Preparation of medicinally important compounds or intermediates required for synthesis of drugs.
3. Monograph analysis of important drugs.
4. Determination of partition coefficients, dissociation constants and molar refractivity of compounds for QSAR analysis.

3.6 PHARMACEUTICAL FORMULATIONS (THEORY)

Topic

1. **Pharmaceutical dosage form**- concept and classification
2. **Tablets:** Formulation of different types of tablets, tablet excipients, granulation techniques quality control and evaluation of tablets. Tablet coating, Type of coating, quality control tests for coated tablet.
3. **Capsules;** Production and filling of hard gelatin capsules, Raw material for shell, finishing, quality control tests for capsules. Production and filling of soft gelatin capsules, quality control tests for soft gelatin capsules.
4. **Liquid orals:** Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations
5. **Parenteral:** Introduction Containers used for Parenterals (including official tests) Formulation of large and small volume Parenterals Sterilization
6. **Ophthalmic preparations (Semi – Solids):** Introduction and classification Factors affecting absorption and anatomy of skin Packaging storage and labeling, Ointments Types of Ointment Base Preparation of ointment, Jellies Types of jellies Formulation of jellies Suppositories, Method of preparation, Types Packaging
7. **Definition and concept** of **Controlled and novel Drug delivery systems** with available examples, viz. parentral, trans dermal, buccal, rectal, nasal, implants, ocular

3.6 PHARMACEUTICAL FORMULATIONS (PRACTICAL)

List of Experiments :

1. **Manufacture of Tablets**
    a. Ordinary compressed tablet-wet granulation
    b. Tablets prepared by direct compression.
    c. Soluble tablet.
    d. Chewable tablet.
2. **Formulation and filling of hard gelatin capsules**
3. **Manufacture of parenterals**
    a. Ascorbic acid injection
    b. Calcium gluconate injection
    c. Sodium chloride infusion.
    d. Dextrose and Sodium chloride injection/ infusion.
4. **Evaluation of Pharmaceutical formulations (QC tests)**
    a. Tablets
    b. Capsules
    c. Injections
5. **Formulation of two liquid oral preparations and evaluation by assay**
    a. Solution: Paracetamol Syrup
    b. Antacid suspensions- Aluminum hydroxide gel
6. **Formulation of semisolids and evaluation by assay**
    a. Salicyclic acid and benzoic acid ointment
    b. Gel formulation Diclofenac gel
7. **Cosmetic preparations**
    a. Lipsticks
    b. Cold cream and vanishing cream
    c. Clear liquid shampoo
    d. Tooth paste and tooth powders.
8. **Tablet coating (demonstration)**