### Medicinal Chemistry Laboratories

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<th>Lab Name</th>
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| Medicinal Chemistry | M12-128  | • Chefa’a Alhourani  
• Nabeel Baniodeh | • College of Pharmacy          | • Practical Medicinal Chemistry,  
Biochemistry & Pharmaceutical Analysis |
| Medicinal Chemistry | M32-G26  | • Lujain Aloum                   | • College of Pharmacy        | • Practical Medicinal Chemistry                        |
| Pharmacognosy   | M32-DF33 | • Rama Alsabbagh                | • College of Pharmacy        | • Practical Pharmacognosy                              |
INTRODUCTION
This course covers experiments on qualitative and quantitative aspects of general chemistry and their applications in the pharmaceutical field, such as separation, identification, determination, purification and extraction procedures.

EQUIPMENT AND INSTRUMENTS
- Analytical Balances
- Top Loading Balances
- Hot Plates and Stirrer
- Oven
- Ice Flaking Machine
- Water Bath
- Centrifuge
- Vacuum Pump
- Separatory Funnel
- Melting Point Apparatus
- Rota Evaporator

EXPERIMENTS
- Laboratory Safety & Measurements
- Qualitative Analysis of Anions
- Qualitative Analysis of Cations
- Physical Properties of Chemicals: Melting Point, Sublimation, and Boiling Point
- Water of Hydration
- Caffeine Extraction
- Analysis of Vinegar by Titration
- Purification Techniques & Recrystallization
- Water hardness & Analysis
- Factors Affecting Rate of Reactions
- pH, Buffer Solutions and Buffer Capacity
- Paper Chromatography; Separation of Plant Pigments
- Analysis of Ascorbic Acid by Oxidation Reduction Titration
INTRODUCTION
This course introduces the basic concepts of medicinal chemistry, including study of the molecular and chemical structures of organic pharmaceuticals using molecular models, preparation of some active ingredients, functional groups reactions and identification of organic compounds such as amine, aldehyde, ketones, alcohols, esters and phenols.

EQUIPMENT AND INSTRUMENTS
• Analytical Balances
• Hot Plates and Stirrers
• Rotatory Evaporators and Vacuum Pumps
• Distillation Apparatuses
• Melting Point Apparatuses
• Water Baths
• Ultrasonic Bath
• Ovens

EXPERIMENTS
• Molecular Models and Stereochemistry
• Factors Affecting Nucleophilic Substitution (SN1) Reaction
• Factors Affecting Nucleophilic Substitution (SN2) Reaction
• Oxidation of Benzyl Alcohol to Benzoic Acid
• Resolution of Racemic Mixture of α-Methylbenzylamine (Part-I)
• Resolution of Racemic Mixture of α-Methylbenzylamine (Part-II)
MEDICINAL CHEMISTRY IB LABORATORY

INTRODUCTION
This course is concerned with the theory and practice of the preparation of some active ingredients in pharmaceutical preparation as well as classical and instrumental methods for the separation, identification and quantitative analysis of chemical substances. Satisfactory completion of this course affords students a working knowledge of analytical instrumentation typically employed in pharmaceutical and biochemical research laboratories. It also provides students with an appreciation of the relative strengths and limitations of different instrumental-based analysis methods.

EQUIPMENT AND INSTRUMENTS
- UV-VIS Spectrophotometer
- GC-MSMS
- GC-FID and GC-ECD
- HPLC-UV
- Analytical Balances
- Hot Plates and Stirrers
- Rotatory Evaporators and Vacuum Pumps
- Water Baths
- Ultrasonic Bath
- Ovens

EXPERIMENTS
- Qualitative Analysis of Functional Groups (Alcohols, Phenols & Carboxylic Acids)
- Qualitative Analysis of Functional Groups (Aldehydes, Ketones, Ester, Amines & Amides)
- Chromatographic Principles & Drugs Mixture Separation using TLC
- Separation of Caffeine and Paracetamol Mixture using HPLC
- Separation and Identification of Hydrocarbon Mixture using GC-FID & GC-MSMS
- Determination of Unknown Concentration using UV-Visible Spectrophotometer

TESTS AND SERVICES
- Development and Validation of Analytical Methods for Analysis of Active Ingredients and Related Substances.
- Routine Quality Control of Pharmaceutical Products
- Accelerated and Real Time Stability Study of Pharmaceuticals
- Heavy Metal Content Determination in Pharmaceutical Sample
INTRODUCTION
The practical part of the course covers experiments on the synthesis of organic compounds and different analysis of drug usage and purification techniques which includes synthesis of chiral drugs and the techniques used in the separation of enantiomers.

EQUIPMENT AND INSTRUMENTS
- Analytical Balances
- Top Loading Balances
- Hot Plates and Stirrer
- Oven
- Water Bath
- Thermometer
- Vacuum Pump
- IR- Spectrophotometer
- Polarimeter
- Ice Flaking Machine
- Reflux Apparatus
- Melting Point Apparatus
- Separator Funnel
- Rotatory Evaporator
- UV Cabinet
- Thin Layer Chromatography Tanks

EXPERIMENTS
- Friedel-Crafts Alkylation
- Nitrating Methyl Benzoate: Electrophilic Aromatic Substitution
- Synthesis of 3-Methylpyrazole-5-One
- Synthesis of Acetanilide
- Diel’s Alder Reaction

TESTS AND SERVICES
- To have Preliminary Idea about the Active Ingredients and their Concentration in the Drug Dosage Forms
- Toxic Elements Detection and Measurement in Food, Water, Soil and other Specimens (With the Help of ICP)
MEDICINAL CHEMISTRY IIB LABORATORY

INTRODUCTION
The practical part of this course deals with experiments on the synthesis of pharmaceutical organic compounds and detection of their purity, stability and biological activity. Experiments to study the chemical and pharmaceutical properties of pharmaceutical drugs are also included in this course in addition to the application of molecular modeling to study the three-dimensional structures of drugs and their structure activity relationship (SAR).

EQUIPMENT AND INSTRUMENTS
- Analytical Balances
- Top Loading Balances
- Hot Plates and Stirrer
- Oven
- Water Bath
- Thermometer
- Centrifuge
- Vacumm Pump
- UV-Vis Spectrophotometer
- Polarimeter
- Ice Flaking Machine
- Reflux Apparatus
- Melting Point Apparatus
- Separator Funnel
- Rotatory Evaporator
- UV Cabinate
- Thin Layer Chromotography Tanks

EXPERIMENTS
- Synthesis of Sulfasalazine
- Synthesis of 5,5-Diphenylhydantoin from Benzyl
- Muticomponent Reactions: Ugi, Passerini, Benelli (Part-I)
- Muticomponent Reactions: Ugi, Passerini, Benelli (Part-II)
- Synthesis and Chemical Analysis of Penicillins
- Structural Data: The Bases for Molecular Modeling (Molecular Docking)

TESTS AND SERVICES
- To have Preliminary Idea about the Active Ingredients and their Concentration in the Drug Dosage Forms
- Toxic Elements Detection and Measurement in Food, Water, Soil and other Specimens (With the Help of ICP)
PHARMACOGNOSY LABORATORY

INTRODUCTION
Plant materials are used throughout all countries from all around the world as home remedies, over the counter which is using drug products and raw materials for the pharmaceutical industry. It is therefore essential to ensure the quality of medicinal plant products by using several techniques and applying suitable standards. One of the most important techniques to authenticate a crude plant drug is the microscopically examine the crude plant or the plant powder. The plant material is prepared for a microscopical examination and the anatomical features of the powdered drugs are recorded in order to compare the structures present with those drawn and described in the relevant monographs. At the end of the lab course, students are able to interpret the morphological and anatomical descriptions of the crude plant in order to clearly identify it.

EXPERIMENTS
• The Morphological and Microscopical Identification/ Authentication of the Herbal Leaves such as Senna Leaves; Peppermint Leaves; Thyme Leaves
• The Morphological and Microscopical Identification/ Authentication of the Herbal Seeds and Flower Drugs such as Black Mustard Seeds, Fenugreek Seeds, Cardamom Seeds, Clove Flower, Chamomile Flower
• The Morphological and Microscopical Identification/ Authentication of Herbal Fruits such as Anise Fruit, Coriander Fruit, Fennel Fruit, Capsicum Fruit
• The Morphological and Anatomical Identification/ Authentication of Herbal Underground Parts (Barks; Rhizomes) such as Cinnamon Bark, Liquorice, Ginger Rhizome, Rhubarb Rhizome, Ginger
• Extraction of Volatile Oil using Steam Distillation Apparatus and Introduction of Techniques for Commercial Production of Volatile Oil from Plant Source
• Phytochemical Investigation of Glycosides
• Phytochemical Investigation of Alkaloids and Extraction of Alkaloid from Plant Source using Soxhlet Apparatus
• Phytochemical Investigation of Carbohydrates
• Extraction of Tannins/ Caffeine from Tea leaves
• Phytochemical Investigation of Flavonoids

EQUIPMENT AND INSTRUMENTS
• Hot Plates and Stirrer
• Clinical Compound Microscope
• Bunsen Burner
• Water Bath
• Vacuum Pump
• Separator Funnel
• Rotatory Evaporator
• UV Cabinet
• Distilled Water Machine
• Thin Layer Chromatography Tanks
• Steam Distillation Apparatus
• Soxhlet Apparatus
• Gas Chromatography Machine

TESTS AND SERVICES
This course gives the pharmacists the skills to identify herbal medicines and detect any adulteration in the herbal products in the market through microscopic examinations. The students learned to identify the phytochemical constituents in plant source which are essential for phytochemical research.