### COURSES OF STUDY FOR B.Sc.:

#### Second Year

**First Semester**

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<th>No.</th>
<th>Course</th>
<th>Weekly hours</th>
<th>Examination degree</th>
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**Second Year**

**First term:**

1. **Physical Pharmacy-2 (2 hrs lect. , 3 hrs pract.):**
   Complexation and protein binding, Kinetics, Diffusion and dissolution, Micrometrics.

2. **General Pharmacognosy and Medicinal Plants-3 (3 hrs lect. , 3 hrs pract.):**
   
   I- **Drugs used as herbs (14 hrs):**
   Mentha, Thyme, Marjoram, Basil, Lobelia, Vinca, Sylubium, Ruta, Ephedra, Half-Bar, Lemon grass, Carrageen, Fucus, Citeraria and Ergot.

   II- **Drugs used as seeds (14 hrs):**
   1- Introduction
   2- Strophanthus seed, Nux-vomica, Linseed, Foenugreek, Cardamom, Nutmegs, Colchicum, Black Mustard, Castor, Almond, Calabar, Psyllium, Coca beens, Nigella, Datura stramonium.

   III- **Drugs used as Fruits: (14 hrs)**
   1- Introduction
   2- Umbelliferous fruits
      Fennel, Anise, Hemlock, Ammi visnaga, Ammi majus, Coriander, Caraway, Dill, Cummin, Celery.
   3- Non-Umbelliferous fruits
      Capsicum, Colocynth, Vanulla Pods, Senna Pods, Cassia Pods, Bitter Orange Peel, Lemon Peel, Cocculus, Black pepper, Cubebs, Star anise, Ramarind Pulp, Juniper, Berries, Prunus, Pimento.
   4- Cereals

3. **Pharmaceutical Organic Chemistry-3 (3 hrs lect. , 3 hrs pract.):**
   
   I- **Aromaticity and benzene derivatives (16 h)**
   1- Resonance theory, Molecular orbital theory, Huckel’s rule for aromaticity. aromatic electrophilic
substitution reactions, classes of benzenoid compounds; synthesis and reaction mechanisms.

2- Monocyclic aromatic hydrocarbons (benzene and its derivatives).
Preparation of benzene and its homologues, Properties of benzene, annules, non-benzenoid aromatic compounds, aromatic ions, aromatic annules, azulene, antiaromatic and non-aromatic, isomerism of benzene derivatives and nomenclature.

3- General mechanisms for electrophilic aromatic substitution $S_{\text{EAr}}$; halogenation, sulphonation, alkylation, acylation. Effect of substituents on $S_{\text{EAr}}$; ortho-para and meta directors.

4- Alkyl benzenes (arenes) and alkenylbenzenes; properties, synthesis and reactions.

5- Aromatic sulphonylic acids.
Benzene and toluenesulphonic acids; properties, synthesis and reactions.

6- Aromatic halogen compounds
Nucleophilic aromatic substitution (aryl halides), addition-elimination, and elimination-addition (Benzyne) mechanisms.

II- Other benzene derivatives (18 h)
1- Phenols and quinones and their reactions.
Nomenclature, homologues, physical properties, preparation, reactions due to the hydroxyl group and reactions on the benzene ring.

2- Aromatic nitro-compounds.
Nitrating agents, mechanisms of nitration, Charge-transfer complexes, Aromatic nitroso-compounds, Reduction products of nitro-compounds.

3- Aromatic amino-compounds
General methods for preparation, properties and reactions.

4- Aromatic alcohols, aldehydes and ketones.
General methods for preparation, properties and reactions.

5- Aromatic carboxylic acids.
Monocarboxylic acids with carboxyl group attached to the ring, or attached to the side chain, properties, synthesis and reactions.

III- Aromatic polynuclear hydrocarbons (8 h)
- Biphenyl, Naphthalene, Anthracene, and Phenanthrene.
Confirmation of structure, derivatives, nomenclature, synthesis, and reactions.

Practical Pharmaceutical Organic Chemistry III for 2nd year pharmacy (1st semester)
General precautions and glassware handling, Techniques, Melting point determination, Recrystallization, Acetylation of salicylic acid, Acetylation of aniline, IR spectra and problems
N.B. This course, also, includes 5 tutorial classes.

4. Pharmaceutical Applied and instrumental analysis-1 (2 hrs lect., 3 hrs pract.):
I- Spectrophotometry
- UV&VIS:
Light and radiation, electromagnetic spectrum, interactions of photon with matter, electronic transitions, chromophores, auxochromes, bathochromic & hypochromic shifts/ hyperchromic and hypochromic effects, absorption characteristics of chromophores, effect of pH on absorption spectra, Beer’s- Lambert’s law, colorimetry, standard series method and varying depth method, photoelectric instruments, applications (qualitative & quantitative).
- Spectrofluorometry:
Principle, fluorescence, phosphorescence, chemical structure and fluorescence, quenching, instruments, applications.
- Atomic absorption and flame emission:
Principle, excitation sources (Flame, non-flame excitation/ Hollow cathode lamp (a-plasma, b-laser, c-arc and spark), flame emission, atomic absorption, atomic fluorescence spectroscopy, theory, Instrumentation, applications.
II- Electrochemistry:

Potentiometry:
Introduction, electrode potential, electrochemical cells, reference and indicator electrodes, potentiometric titrations.

Conductimetry:
Introduction, conductance measurement, bases of conductimetric titrations, advantages of conductimetric titrations, applications.

Polarography:
Basic principles/ factors affecting the limiting, residual and diffusion currents, dropping mercury electrode, polarogram, half-wave potential, quantitative applications for inorganics and organics.

III. Thermal analysis:
Theory, types (thermogravimetry, differential scanning calorimetry), applications.

5. General and Pharmaceutical Microbiology-1, 2 (2 hrs lect. , 2 hrs pract.):
I- General microbiology:
A) General bacteriology
Structure of bacterial cell, bacterial physiology and metabolism, bacterial genetics, recombinant DNA technology and its applications, virulence factors of bacteria, antimicrobial chemotherapy, sterilization and disinfection.
B) General virology
Structure of virus, replication of viruses, general properties of viruses, genetics and gene therapy, classification of medically important viruses, pathogenesis and antiviral drugs.
C) General mycology
Structure and growth, pathogenesis, fungal toxins and allergies and antifungal drugs.
II- Immunology.
Immunity, cellular basis of the immune response, antigens and antibodies, humoral immunity, cell-mediated immunity, major histocompatibility complex and transplantation, complement, antigen-antibody reactions in the laboratory, hypersensitivity (allergy), tolerance and autoimmune diseases, tumor immunity and immunodeficiency.

6. Pharmacy law (1 hr lect.):
الفصل الأول:
"مزاولة مهنة الصيدلة"
الفصل الثاني:
"المؤسسات الصيدلية" تعرف، أحكام عامة لكل المؤسسات الصيدلية (المؤسسات العامة، الصيدليات الخاصة، وسطاء الأدوية، مخازن الأدوية، محلات الإتجار، النباتات الطبية ومحاصيلها، صناع المستحضرات الصيدلية).
الفصل الثالث:
المستحضرات الصيدلية الخاصة والإدارية.
الفصل الرابع:
استيراد الأدوية والمستحضرات الصيدلية والمستحضرات الأقربازينية والنباتات الطبية ومستحضراتها الطبيعية.
الفصل الخامس:
أحكام عامة.
الفصل السادس:
العقوبات.
الفصل السابع:
أحكام وقتية.
الفصل الثامن:
أحكام خانمية.
الجدول الأول:
المواضيع التي تحظرها في أماكن مغلقة ومحلية ومثبت عليها "مواد سامة" ويرسم عليها جمجمة وعضمتان.
الجدول الثاني:
المستحضرات الصيدلية الجاهزة التي لاتصف إلا بعمرة طبية.
الجدول الثالث:
المخدرات.
الجدول الرابع:
الأدوية التي يجوز للصيادي صرفها بموجب تذكرة من مصرفية المولدات.
الجدول الخامس:
المواضع المبسطة التي يصرف بالإتجار فيها في مخازن الأدوية البسيطة.
الجدول السادس:
المواضع القابلة للالتهاب
المواضع القابلة للفرط
المواضع الخطرة
شروطات صحية خاصة بإنشاء المؤسسات الصيدلية.
Second term:
1- Pharmaceutics-1 (2 hrs lect. , 3 hrs pract.):
Semisolid dosage forms: Ointments, gels and pastes.
Suppositories.
Cosmetics
Capsules and tablets

Preformation

2. General Pharmacognosy and Medicinal Plants-4 (2 hrs lect. , 3 hrs pract.):
I- Drugs used as Rhizomes: (10 hrs)
1- Introduction
2- Rhubrab, Ginger, Galangal, Curcumma, Hydrastis, Colchicum corm, Filix-Mas Valerian, White Hellebore, Green Hellebore, Podophyllum, Garlic.

II- Drugs used as Roots: (10 hrs)
1- Introduction.
2- Lpecacuanha, Liquorice, Gentian, Senega, Calumba, Krameria, Althaea, Aconite, Jalap, Rauwolfia, Sarsaparills, Alkanna, Dandelion, Ginseng.

III- Unorganized and animal drugs: (8 hrs)
Opium, Aloes, Benzoin, Aloes, Benzoin, Balsam Rolu, Black Catechu, Cod-liver oil, Beeswax, Spermacet, Wool Fat, Cantharides, Cochineal, Scorpion venom, Snake venoms, Honey, Royel Jelly, Musk, Ambergris.

3. Pharmaceutical Organic Chemistry-4 (3 hrs lect. , 3 hrs pract.):
Course contents:
1- Chemistry of heterocyclic compounds (21 h):
Furan, Thiophen, Pyrrole, Indole, Pyrazoles. Imidazoles, Oxazoles, Thiazaoles, Pyridine, Diazines, Quinoline, Isoquinoline, Pyrans, Pyrones, and Purines. Structure, properties, synthesis, electrophilic substitution reactions, nucleophilic substitution reactions, and addition reactions.
2- Spectroscopic identification of organic compounds (21 h):

**Infrared spectroscopy:**
Molecular vibrations, IR spectrum regions, effect of hydrogen bonding, IR absorptions of different types of functional groups, applications of infrared spectroscopy.

**Nuclear magnetic resonance spectroscopy.**
Nuclear spin, characteristics of NMR signals, chemical shifts, diamagnetic effects, magnetic anisotropic effect, spin-spin coupling, PASCAL’s triangle, $^{1}$HNMR absorptions of different types of protons, applications of $^{1}$HNMR spectroscopy, and a brief account about $^{13}$CNMR spectroscopy

**Mass spectroscopy**
Mass spectrometer, mass spectrum, fragmentation, and applications of mass spectrometry.

**Practical Pharmaceutical Organic Chemistry IV for 2$^{nd}$ year pharmacy (2$^{nd}$ semester)**
1- Bromination of acetanilide.
2- Hydrolysis of $p$-bromoacetanilide
3- Azo dyes and Iodoform
4- Distillation
5- NMR integrated problems
6- MS integrated problems
N.B. This course, also, includes 6 tutorial classes.

4. **Pharmaceutical Applied and instrumental analysis-2 (2 hrs lect. , 3 hrs pract.):**

**I- Chromatography:**
Introduction, Types of chromatographic methods, principles of chromatography (theory & terminology), column resolution, column efficiency, applications, TLC, PC, HPLC, GC, electrophoreses.

**II- Analysis of oils and fats:**
Introduction, Components of oils, fats, fatty acids, unsaponifiable matter, non-drying, semi-drying, drying examples of oils, stability of oils, Rancidity, physical,
colour tests, constant values & chemical examination of oils and fats, adultration of oils and fats.

**III. Water quality control:**
Introduction, pharmaceutical waters, water treatment and purification, physical examination, chemical examination, acidity, alkalinity, hardness, residual chlorine, nitrogen forms analysis, dissolved oxygen, chemical oxygen demand, heavy metals, anions.

5. General and Pharmaceutical Microbiology-2
(2 hrs lect. , 2 hrs pract.):
I- Pharmaceutical microbiology:
Disinfectants, abtiseptics, preservatives, microbial contamination of pharmaceutical preparations, microbial control of non-sterile pharmaceutical products, aseptic area, factors affecting antimicrobial activity of antimicrobial agents, sterility testing, microbiological assay of antibiotics, microbiological assay of accessory factors, microbiological quality of pharmaceuticals, biotechnology and industrial microbiology, production of pharmaceuticals by microorganisms, designing of a fermentation unit for industrial fermentation, media and raw materials used for fermentation, ethyl alcohol (acetic acid, butanol, acetone, lactic acid, citric acid, glutamic acid, dextran) production by fermentation, production of enzymes and vitamins and antibiotics (penicillins, streptomycin, tetracycline and grisiofulvin) by microorganisms, steroid transformation by microorganisms, production of cortisone from progesterone by fermentation, industrial engeneering, recombinant DNA technology, gene cloning and expression, monoclonal antibody production, insulin production and recombinant vaccines.

II- Medical microbiology
A- Medical bacteriology
Gram positive cocci (staphylococci, streptococci, pneumococci), Gram negative cocci (Neisseria), Gram positive rods (Corynebacterium, Bacillus species, mycobacterium and clostridium), Gram negative rods (Enterobacteriaceae [E. coli, Klebsiella, Enterbacter, Salmonella, Shigella, Proteus, Yersinia], pseudomonas, Vibrios, brucella, Haemophilus and Bordetella), spirochetes (Terponema, Borellia and Liptospira), mycoplasma, legionella and richettsiae.
B- Medical virology
Classification of viruses,
RNA viruses (Picorna viruses [Poliovirus-Enteroviruses-Hepatoviruses], Reo viruses [Rotavirus], Orthomyxo viruses [Influenza viruses], Paramyxoviruses [Measles-Mumps-Parainfluenza], Rhabdoviruses [Rabies], Retroviruses [HIV, HTLV], Togaviruses [Encephalitis], Flaviviruses [yellow fever-Dengue-HCV-HGV], Corona viruses [SARS] and Delta viruses [HDV].
DNA viruses (herpes viruses [HSV I and II, CMV and EBV, Hepadnaviruses [HBV], pox viruses [smallpox-cowpox] and adenoviruses.

C- Medical mycolgy
Cutaneous and subcutaneous mycoses, systemic mycoses, opportunistic mycoses and diagnostic medical microbiology.

6.1. Pathology (2 hrs lectr., 1 hr pract.):
Inflammation; Repair (healing); Cell response to injury: Gangrene; Bacterial infections: Mode of infection, mechanism of disease, production, effects, types, common acute bacterial infections (staphylococcal infection, streptococcal infection), complications (toxaemia, bacteraemia, septicemia, pyemia).

6.2. Parasitology (2 hrs lectr., 1 hr pract.):
Introduction for general parasitology. Helminthology: Phylum Platyhelminthes or flat worms. Phylum Nemathelminthes: which includes Nematoda "round worms": Class Trematoda "flukes". Class Cestoda "tape