Benghazi University

Faculty; Pharmacy

Department; Pharmaceutical chemistry

Course title; Medicinal Chemistry

Course Specifications;

Program on which the course is given: Bachelor of pharmaceutical sciences

Academic year: level 4thyear

Date of course specification approval:

1. Basic Information;

Title; Medicinal chemistry II **Code:** **Credit hours;** 5 hours

Lecture; Theory (3 hrs) **and Practical** ;(2hrs) **Total; (5**hrs) hour/week.

2. Course Objectives;

This course is designed for students with a chemistry background—organic chemistry and biochemistry in particular—who are interested in a molecular understanding of drug action and how this understanding informs pharmaceutical development. Medicinal chemistry is a multi-disciplinary course and will venture into chemistry's allied fields of cell biology, physiology, microbiology, virology, and pharmacology. As such, this course will be of interest to students considering careers in medicinal chemistry and pharmacological research, the pharmaceutical industry, pharmacy, and medicine.
This course is the second part of the medicinal chemistry class (II) and is focused on some selected topics in medicinal chemistry.

3. Intended Learning Outcomes (ILOs);

By the end of this course, the student should be able to demonstrate knowledge and understanding of: Definition, chemical classification, chemical structure, chemical name, mechanism of action, SAR, specific uses, adverse effects, of the following classes of drugs for topics ***I*** to ***IX.***

4.A. Theory contents:

	Topic	Lectures
1.	**Drug Affecting Neurotransmission (PNS Drugs)**	**10**
	1.1 Discuss the introduction of autonomic nervous system.	1
	1.1.1 Cholinergic (parasympathetic) System	
	1.1.1.1 Describe the (Secretion, Reabsorption, biosynthesis, SAR) of acetylcholine.	1
	1.1.1.2 Discuss cholinergic receptors (Nicotinic, Muscarinic).	1
	1.1.1.3 Acetylcholine As An agonist: **1.1.1.3.1** Advantages and disadvantages of Acetylcholine As An agonist. **1.1.1.3.2** Active Conformation Of Acetylcholine. **1.1.1.3.3** Instability Of Acetylcholine. **1.1.1.4** Nicotine And Muscarine As Cholinergic Agonists. **1.1.1.5** Requirements For Cholinergic Agonists.	2
	1.1.1.6 Explain (chemical structure, SAR, therapeutic uses, and side effects of cholinergic agonist drugs: **1.1.1.6.1** Cholinocepter agonists: ➢ Choline esters e.g: Methacholine, Carbachol, and Bethanechol. ➢ Alkaloids e.g: Pilocarpine, and Arecoline. **1.1.1.6.2** Acetylcholinesterase inhibitors (AChEIs): ➢ Reversible: **A.** Carbamates e.g physeostigmine, Neostigmine, and Pyridostigmine. **B.** Acridinde: Tacrine. ➢ Irreversible: Organophosphates, DFP, Parathion and Malathion.	
	1.1.1.7 Explain chemical structure and SAR of cholinergic Antagonists (Muscarinic, and Nicotinic)	1
	1.1.2 Adrenergic (sympathetic) System	
	1.1.2.1 Describe the (biosynthesis, metabolism, distribution, SAR) of *Epinephrine & Norepinephrine*.	1
	1.1.2.2 Discuss adrenergic receptors(*α and B receptors)*.	1
	1.1.2.3 Explain chemical structures and SAR of adrenergic agonists: ➢ Direct adrenergic drug action ➢ Indirect adrenergic drug action ➢ Mixed action	1
	1.1.1.5 Explain chemical structure and SAR of adrenergic Antagonists: *(α and B receptors antagonists)*	1
2.	**Steroids and steroidal Hormones**	**8**
	2.1 Discuss introduction and Basic Concepts of steroid hormones: **2.1.1** steroid hormone receptor complex. **2.1.2** Types of steroidal hormones. **2.1.3** outline of the biosynthesis of steroid. **2.1.4** Structure and nomenclature (numbering) of steroids.	1
	2.2 Describe the (biosynthesis, metabolism, SAR, therapeutic effects) of female sex hormones.	1
	2.3 Explain chemical modifications of Estradiol (orally active and injectable estrogens,	1

	and conjugated estrogens). **2.4** Explain chemical structures and SAR of Synthetic non-steroidal estrogens.	
	2.5 Explain chemical structures and SAR of Estrogen antagonists: **2.5.1** Non-steroidal estrogen blockers: (Clomiphene, Tamoxifen, Raloxifene, Nafoxidine). **2.5.2** Steroidal estrogen receptor antagonists(Fluvestrant). **2.5.3** Steroidal and non-steroidal aromatase inhibitors. **2.5.4** Progesterones (metabolism, modifications).	1
	2**.6.1** Explain chemical structures, SAR, and composition of Oral contraceptives. **2.6.2** Explain chemical structure and SAR of Progesterone antagonists. **2.6.3** Describe the (biosynthesis, metabolism, SAR, modifications) Male sex hormones.	1
	2.7.1 Describe chemical structures, and SAR of Anabolic compounds: (Oxandrolone, Stanazolol, 19-norandrogens, Norethandrolone, Ethylestrenol **2.7.2** Describe chemical structures, and SAR Male contraceptives. **2.7.3** Explain chemical structures, and SAR of Androgenic antagonists: (competitive steroidal antagonists, competitive non-steroidal antagonists, inhibitors of androgen biosynthesis).	1
	2.8 Describe the (biological activity, types, biosynthesis, pathological effects, indications, SAR, and inhibitors) of Adrenocorticoids.	1
	2.9 Discuss the (chemistry of Cardiac glycosides, classes, how they work, SAR, sugar of cardiac glycosides, metabolism) of Cardiac glycosides.	1
3.	**Drug Affecting cardiovascular system (CV Drugs)**	13
	3.1. Discuss the definition, Classification of (Antihypertensive agents, Antianginal drugs, Antiarrhythmic drugs, Anti-hyperlipidemic agents and Anticoagulants). **3.2** Explain the (introduction, Mechanism of action, Development, Classification, SAR, Indications and Side effects) of Antihypertensive agents such as (Captopril, Enalapril, Ramipril, Lisinopril, Fosinopril, Losartan, Valsartan, Irbesartan, Telmisartan, Candesartan, Olmesartan medoxomil, Verapamil, Diltiazem, Nifedipine, Felodipine, Nimodipine, Nicardipine, Amlodipine and Isradipine)	2
	3.3 Describe the (Definition, Site and Mechanism of action, Classification, SAR, Clinical indications and Adverse effects) of Diuretics such as Acetazolamide, Methazolamide, Dichlorphenamide, Chloraminophenamide, Chlorothiazide, Hydrochlorothiazide, Polythiazide, Quinethazone, Metolazone, Furosemide, Azosemide, Bumetanide, Piretanide, Spironolactone, Triamterene, Amiloride and D-Mannitol).	2
	3.4 Explain the (Introduction, Mechanism of action, Classification, SAR, Clinical indications and Adverse effects) of vasodilators such as Hydralazine, Minoxidil, Diazoxide, Milrinone, Sodium nitroprusside, Terazosin, Prazosin, Doxazosin, Penbutolol, Carteolol, Nadolol, Propranolol, Timolol, Pindolol, Acebutolol, Atenolol, Betaxolol, Esmolol, Metoprolol, Bisoprolol, Labetolol, Carvedilol, Methyldopa, Clonidine, Guanafacine, Guanabenz, Reserpine, Guanethidine and Guanaderl.	2
	3.5 Explain the (Introduction, Mechanism of action, Classification, SAR, Adverse effects) of Antiarrhythmic drugs such as: (Quinidine, Procainamide, Disopyramide, Lidocaine, Phenytoin, Mexiletine, Tocainide, Flecainide, Encainide, Indecainide, Acebutolol, Esmolol, Sotalol, Bretylium tosylate and Amiodarone)**.**	2
	3.6 Explain the (Introduction, Mechanism of action, Classification, SAR, Side effects) of Anti-hyperlipidemic agents such as lovastatin, simvastatin, Pravastatin**,** Fluvastatin**,** Atorstatin, Clofibrate, Fenofibrate, Ciprofibrate, Gemfibrozil, Bezafibrate,	2

	Cholestyramine, colestipol and Ezetimibe.	
	3.7 Describe the Introduction, Mechanism of action, Classification, Adverse reactions of antianginal agents such as: **3.6.1** Rapid onset and short duration of action e.g Glyceryl trinitrate (nitroglycerine). **3.6.2** Slow onset and long duration of action e.g Pentaerythritol tetranitrate, Isosorbide dinitrate, Isosorbide mononitrate).	1
	3.8 Explain the (Introduction, Mechanism of action, Classification, Chemistry, SAR, Adverse effects) of Cardic glycosides such as Lanatoside C, Digoxin, Digitoxin.	1
	3.9.1 Introduction, Mechanism of action, Classification, SAR, Adverse effects) of Anticoagulants: Heparin and Oral Anticoagulants: Dicoumarol e.g Warfarin) **3.9.2 Discuss the (Definition, Classification) of Antiplatelet drugs**: **3.9.2.1** Irreversible cyclooxygenase inhibitors e.g Aspirin and Triflusal, Adenosine diphosphate (ADP). **3.9.2.2** Receptor inhibitors e.g Ticlopidine and Clopidogrel. **3.9.2.3** Phosphodiesterase inhibitors e.g Cilostazole. **3.9.2.4** Glycoprotein IIB/IIIA inhibitors e.g Tirofiban.	1
4.	**Drugs controlling pain and inflammation**	**8**
	Non-Steroidal Anti-inflammatory agents (NSAIDs)	3
	Local Anesthetics	2
	Narcotic Analgesic	3
5.	**Drugs for the control of Diabetes**	**3**
6.	**Drugs for Gastrointestinal Disorder**	**2**
7.	**Antihistaminic Drugs**	**6**
	Introduction and Drugs Acting on H2 receptor	3
	7.2.1 Discuss the introduction and chemistry of histamine. **7.2.2** Discuss the physiological characters (biosynthesis, metabolism, storage and release) of histamine. **7.2.3** Discuss histamine Receptors—Molecular and Mechanistic Aspects.	1
	7.3.1 Explain SAR of the first generation antihistaminic of H1 receptor antagonist. **7.3.1.1** Explain (chemical structure, therapeutic uses, and metabolism) of Amino alkyl ethers (Ethanolamines) e.g: **(**Diphenhyramine, carbinoxamine, and clemastine fumarate). **7.3.1.2** Explain (chemical structure, SAR, therapeutic uses) of saturated and unsaturated Propylamine derivatives e.g (chlorpheniramine, triprolidine, dimethindene maleate. **7.3.1.3** Explain (chemical structure, SAR, therapeutic uses) of Ethylenediamines e.g: Tripelennamine, Antazoline phosphate. **7.3.1.4** Explain (chemical structure, SAR, metabolism, therapeutic uses) of Piperazine derivatives cyclizines e.g Buclizine hydrochloride, Hydroxyzine. **7.3.1.4** Explain (chemical structure, SAR, metabolism, therapeutic uses) of Tricyclic ring system e.g promethazine, phenothiazine analogues, Azatadine.	1
	7.4.1 Discuss characters of the Second generation antihistaminic of H1 receptor antagonist. **7.4.2** Explain (chemical structure, SAR, therapeutic uses and) of the Second generation antihistaminic of H1 receptor antagonist e.g Terfenadine, fexofenadine, Acrivastine, Cetrizine, and Loratadine. **7.4.3** Describe inhibition of histamine release e.g cromolyn sodium.	1
8.	**Drugs for Respiratory System Disorders.**	**2**

	8.1 Discuss introduction to respiratory (function, control, Airway smooth muscle tone and innervation, Drugs that alter respiration) **8.2** Discuss the respiratory tract disorders. 8.3 Explain (chemical structure, and SAR) of drugs used to treat: **8.2.1** Rhinitis and rhinorrhea: Nasal Decongestants e.g: ➢ Indirectly acting sympathomimetics (phenylprppanolamine, Metaraminol, Mephentermine, phseudoephedrine, and ephedrine). ➢ α1 selective agonists e.g (phenylephrine, Methoxamine). ➢ α selective agonists e.g (Naphazoline, tetrahdrozoline, oxymetazoline)	1
	8.2.2 Bronchial Asthma: ➢ B2 selective agonist e.g: colterol, salbutamol, terbutaline, salmeterol, formoterol, and fenoterol. ➢ Phosphodiestrase inhibitors e.g Theophyllin. ➢ Muscurinic antagonists e.g: Ipratropium **8.2.3** Anti-inflammatory drugs: ➢ Mast cell stabilizers e.g: cromolyn sodium, ketotifen. ➢ Corticosteroids e.g: Beclomethasone. ➢ Leukotriene inhibitors e.g Zafirlukast. **8.2.4** Drugs for cough: ➢ Antitussives e.g Benzonatine, dextromethorphane, and dextromethorphene. ➢ Expectorants and mucolytics e.g: Guaifnisin, and Bromohexin.	1
9.	**Drugs Acting on Central Nervous System**	**9**
	CNS Depressants	5
	CNS Stimulants	2
	Antidepressant	2
	Total	**61**

4.B: Practical content

Experiment No.	TITLE/ CONCEPT
1	Mole inspiration(software)
2	Assay of Euglucon tablet (acid –base titration)
3	Assay of Lithium carbonate tablet (acid –base) OR SYNTHESIS OF ASPIRIN
4	Assay of Acetyl Salicylic Acid Tablet (acid-base titration)
5	Assay of Acetyl Salicylic Acid Tablet (spectrophotometry as comparative with previous exp.
6	Assay Eposome salts (EDTA)
7	Determination of Paramol®(spectrophotometry)
8	Assay of captopril tablet (Iodimetry)

5. **Teaching and Learning Methods;**

(All methods below can be used)

5.1. Tutorial.

5.2. Presentation.

5.3 Data show.

c. Weighing of Assessments;

Assessment Examination: 60 marks/300

Final Examination; 180marks/300

Oral Examination None

Practical Examination 60marks/300

Other types of examination ----------

300 marks Total 100%

7. List of References;

No.	Reference	Type
1.	An introduction to medicinal chemistry: Graham Patrick, Oxford Press. , ISBN 0199234477	textbook
2.	Foye's Principles of Medicinal Chemistry (Lemke, Foye's Principles of Medicinal Chemistry).	textbook

8. Disclaimer:
Teaching policies and regulations for this course are not open for discussion or negotiation. This syllabus has been constructed to be as complete as possible but is by no means a binding document. I reserve the right to alter policies and regulations as needed.

Course coordinator: **Dr. Najwa. F.Alshwihdy**
Head of Department: **Dr. Ruwida snini**