



<b>Form: Course Syllabus</b>	<b>Form Number</b>	EXC-01-02-02A
	<b>Issue Number and Date</b>	2963/2022/24/3/2 5/12/2022
	<b>Number and Date of Revision or Modification</b>	2/(10/12/2023)
	<b>Deans Council Approval Decision Number</b>	50/2023
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	<b>Number of Pages</b>	06

1.	<b>Course Title</b>	Medicinal Chemistry
2.	<b>Course Number</b>	1201710
3.	<b>Credit Hours (Theory, Practical)</b>	3, Theory
	<b>Contact Hours (Theory, Practical)</b>	3, Theory
4.	<b>Prerequisites/ Corequisites</b>	None
5.	<b>Program Title</b>	Master of Science in Pharmaceutical Sciences
6.	<b>Program Code</b>	40
7.	<b>School/ Center</b>	Pharmacy
8.	<b>Department</b>	Pharmaceutical Sciences
9.	<b>Course Level</b>	9 <sup>th</sup>
10.	<b>Year of Study and Semester (s)</b>	2 <sup>nd</sup> Year, 2 <sup>nd</sup> Semester.
11.	<b>Other Department(s) Involved in Teaching the Course</b>	NA
12.	<b>Main Learning Language</b>	English
13.	<b>Learning Types</b>	<input checked="" type="checkbox"/> Face to face learning <input checked="" type="checkbox"/> Blended <input type="checkbox"/> Fully online
14.	<b>Online Platforms(s)</b>	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams
15.	<b>Issuing Date</b>	November 2024
16.	<b>Revision Date</b>	November 2024

**17. Course Coordinator:**

Prof. Dr. Yusuf Al-Hiari, BSc, MSc, PhD. Office 313 Phone: 5355000, ext. 223292 E-mail: hiary@ju.edu.jo WeBsite: <a href="http://pharmacy.ju.edu.jo/Lists/FacultyAcademicStaff/Disp_Staff.aspx?ID=41&amp;Dept=Pharmaceutical Sciences">http://pharmacy.ju.edu.jo/Lists/FacultyAcademicStaff/Disp_Staff.aspx?ID=41&amp;Dept=Pharmaceutical Sciences</a>
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**18. Other Instructors:**

Name: Prof. Ghadeer Suaifan, BSc, MSc, PhD.

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Office hours to be announced

**19. Course Description:**

This course covers the latest literature review, methodologies and data retrieval methods in the area of pharmaceutical chemistry/Medicinal chemistry. It also comprises brief studies in chemistry, biochemistry, pharmacology and metabolism of known clinically important natural and synthetic steroids. Steroid receptors as new targets, are to be emphasized for drug development. Pharmaceutical Biotechnology, as an advanced tool in drug discovery, will be covered. Some recently explored target receptors and their new agents will be discussed and validated. Self-learning capabilities are aimed via computer-aided learning sessions and student's presentations, are to be adopted.

**20. Program Intended Learning Outcomes:** (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Demonstrate advanced knowledge and deep understanding of essential facts, concepts, principles and theories of drug discovery and development including synthetic strategies, retro-synthetic analysis of organic and natural product and techniques applied in drug design and drug discovery different analytical methodologies used in the identification and quantification of drugs or natural and synthetic origin.
2. Demonstrate advanced knowledge and deep understanding of essential facts, concepts, principles and theories of pharmaceuticals and dosage forms development, physical chemistry, drug formulation, drug targeting, stability and bioavailability in medical or cosmetic preparations.
3. Apply advanced mathematical and statistical methods required for the treatment of complex scientific problems and research results.
4. Plan and carry out experiments independently, including the conduct of advanced laboratory procedures and use of instrumentation in synthetic and analytical work or biochemical and microbial assessment.
5. Prepare definite research plans and evaluate results analytically and critically independently and demonstrate self-direction and originality in the application of knowledge.
6. Demonstrate self-directing and ability to learn independently and evaluate critically current research and methodologies and problem solving.



7. Deal with complex issues both systemically and creatively, make sound judgments in the absence of complete data, and communicate their conclusions and scientific findings clearly to specialist and non-specialist audiences in forms of oral presentations or scientific writing.
8. Demonstrate and exercise the initiative and personal responsibility; decision-making in complex and unpredictable situations, and ability to work in a group and in the interdisciplinary and international environment.

**21. Course Intended Learning Outcomes:** (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Analyze the latest literature in pharmaceutical and medicinal chemistry to identify trends and innovations in drug discovery, particularly involving steroid compounds.
2. Evaluate various methodologies and data retrieval techniques used in pharmaceutical chemistry research, with an emphasis on their application to steroid-based drug discovery.
3. Explain the chemical, biochemical, and pharmacological principles underlying the activity of clinically important natural and synthetic steroids.
4. Identify and discuss the role of steroid receptors as therapeutic targets, and assess the impact of these targets on drug development strategies.
5. Apply principles of pharmaceutical biotechnology in the context of drug discovery, focusing on the design, development, and validation of new agents for clinically relevant receptors.
6. Develop self-directed learning skills through computer-aided learning sessions, critical literature reviews, and student presentations, fostering independent research capabilities.
7. Design a basic proposal for the validation of new agents targeting specific receptors, using a combination of computational and experimental approaches learned in the course.
8. Demonstrate responsibility, accountability, and commitment by respecting professors and classmates and complying with relevant university regulations.
9. Demonstrate strong teamwork, critical thinking, and creative problem-solving abilities.

Course ILOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
1				✓		
2					✓	
3		✓				
4		✓	✓			
5		✓	✓			
6						✓
7						✓



8		✓	✓			
9				✓		✓

**22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:**

Descriptors	ILOs	PLOs										
		PLO (1)	PLO (2)	PLO (3)	PLO (4)	PLO (5)	PLO (6)	PLO (7)	PLO (8)	PLO (9)		
Knowledge	K1	Analyze the latest literature in pharmaceutical and medicinal chemistry to identify trends and innovations in drug discovery.	✓									
	K2	Evaluate various methodologies and data retrieval techniques used in pharmaceutical chemistry research, with an emphasis on their application to drug discovery.	✓		✓							
	K3	Explain the chemical, biochemical, and pharmacological principles underlying the activity of clinically important natural and synthetic drugs including steroids.	✓	✓								
	K4	Identify and discuss the role of different receptors as therapeutic targets, and assess the impact of these targets on drug development strategies.	✓							✓		



Skills	S1	Apply principles of pharmaceutical biotechnology in the context of drug discovery, focusing on the design, development, and validation of new agents for clinically relevant receptors.	✓			✓		✓			
	S2	Develop self-directed learning skills through computer-aided learning sessions, critical literature reviews, and student presentations, fostering independent research capabilities.					✓	✓			
	S3	Design a basic proposal for the validation of new agents targeting specific receptors, using a combination of computational and experimental approaches learned in the course.				✓	✓				
Competencies	C1	Demonstrate responsibility, accountability, and commitment by respecting professors and classmates and complying with relevant university regulations.								✓	
	C2	Demonstrate strong teamwork, critical thinking, and creative problem-solving abilities.							✓	✓	



## 23. Topic Outline and Schedule:

Week	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous	Evaluation Methods	Learning Resources
1-2	A Journey into the World of Pharmaceutical Innovation.	K1, K2	Face to Face/ Blended	Moodle and MS Teams	Synch	Quizzes, short tasks on e-library databases and software	Provided according to lectures
3-4	Medicinal chemistry as multidisciplinary science- Lists of drugs	K1, K3	Face to Face	Moodle and MS Teams	Synch	Exam	Provided according to lectures
5	Literature Review and Data Retrieval Methods Related to Pharmaceutical Sciences/Chemistry -Software, databases, full-text courses, journals, and books -Writing and presenting skills Recent targets (approaches) -Traditional therapies - Biotech. Therapy, -Synthetic drugs	K2, K4, S1, S2, C1, C2	Face to Face/ Blended	Moodle and MS Teams	Synch	Presentations, Discussions, Short tasks, and home works	4, 5
6	Pharmaceutical Biotechnology from a chemistry point of view. - Definition, statistics, and numbers -Introduction, approaches, and applications -Biopharmaceutics Recombinant DNA technology: - Introduction to genetics: -Gene cloning, gene expression and protein production (Gene cloning in Escherichia coli)	K2, K3, S1	Face to Face	Moodle and MS Teams	Synch	Exams and Quizzes	1, 2, 3
7	Expression of foreign genes in prokaryotes and eukaryotes - Commercial applications of genetic engineering: Pharmaceutical biotechnology products Targeted therapy: Monoclonal antibodies: principle, classes, production and applications	K4, S1	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	1, 2, 3



Week	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous	Evaluation Methods	Learning Resources
8	<p>Monoclonal therapy: - Anticancer, Anti-inflammatory: Autoimmune and beta cell, TNF-A MAB, adalimumab, Organ transplant, Antiplatelet, Anti-infective, Anti-inflammatory, Anti-asthma, Antiosteoporosis.</p> <p>- Targeted therapy: Antisense therapy Mipomersin (Kynamro* 2013) for familial Hypercholesterimia</p> <p>- RNA interference as a future approach: post-transcriptional gene silencing</p>	K4, S1, S3	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	3, 5
9	<p>Tyrosine kinase inhibitors: TKI anticancer</p> <p>-BCR-ABL TKI inh: Gleevic (imatinib), Ponatinib (Iclusig)</p> <p>- Epidermal growth factor TKI: Gefitinib (Iressa)</p> <p>- Vascular endothelial GF TKI: sunitinib(sutent*)</p>	K4, S1, S3	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	1, 2 ,3 ,5
10	<p>SGLT-2 Inhs: Canaglifloain (Invokana*): inh Ns-Glucose co-transporter 2 in proximal renal tubules</p> <p>DPP-IV inhib for DM; gliptin class:</p> <p>-Substrate like inh: Vildagliptin (galvus)</p> <p>-None-substrate like inh: Sitagliptin (Januvia)</p> <p>-Xanthine: Alogliptin (Nesina)</p>	K4, S1, S3	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	1, 2 ,3 ,5
11	<p>PPARs modulators:</p> <p>-gamma agonist: thiazolidine dione like glitazone class: actos*</p> <p>-Dual agonist (alpha and gamma): Glitazars class: tesaglitazar (Galida) ,Saroglitazar (Lipaglyn)</p>	K4, S1	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	5
12	-Marine drugs: mainly anticancer: Yondelis; Trabectedin;	K3, K4, S1	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	1, 2, 3, 5



Week	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous	Evaluation Methods	Learning Resources
	-Selective COX-II inhibitors as anti-cancer -Anti histamines: First and Second generation -Selective estrogen receptor modulators (Raloxifene®) -Estrogen aromatase inhibitors: arimidex -Anticoagulants/ Apixaban/Rivaroxaban -Direct thrombin inhibitors: Hirudin -antiplatelet therapy: P2Y12 antagonists: Plavix/ Brilinta						
13	-Proteases and metastasis -angiogenesis inhibitors -Parib Inhibitors -New agents related for both classes such as H3- receptor modulator - Statins	K4, S1	Face to Face	Moodle and MS Teams	Synch	Exam and Quizzes	5
14	11-Steroids and Therapeutically Related Compounds -Steroid receptors and therapeutic classis -Introduction to steroids: structure, nomenclature, and biosynthesis - Estrogens, Androgens, Progestins, -Adrenocorticoids and cardiac glycosides. -New agents related to the above groups	K3, K4, S1, C1, C2	Face to Face	Moodle and MS Teams	Synch	Exams, Quizzes,	2, 3
15	New cancer receptors and their agent: HDAC, TK, CDK4 and CDK6, mTOR inhibitor , <b>BRAF</b> kinase inhibitor, DNMT inhibitors. <b>PI3K</b> inhibitors, <b>JAK1/2</b>  Self learning: Computer-aided learning sessions: Self-learning animation, Software, databases	S2, S3	Blended	Moodle and MS Teams	Synch	Short tasks, Quizzes, assignments	Self-provided by lecturer
16	Final Exam						



#### 24. Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	ILO/s Linked to the Evaluation activity	Period (Week)	Platform
Midterm Exam	30 M	1, 2, and 3	K1,K2, K3, S1, S2, C1, C2	Week 8	On Campus
Semester Work (Presentation and Discussion)	30 M	Seminars on the recent synthesis of selected interesting molecules.	K1, K3, S1,S2,C1, C2	Week 12	On Campus
Final Exam	40 M	All topics	K1, K2, K3,K4, S1, S2, S3, C1, C2	Week 16	On Campus

#### 25. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform...etc.):

Students should have a computer, internet connection and an account on Moodle and MS Teams.

#### 26. Course Policies:

##### A. Attendance policies:

- According to the University Regulations
- Attendance: Mandatory.

##### B. Absences from exams and submitting assignments on time:

- Will result in zero achievement unless health report or other significant excuse is documented.

##### C. Health and safety procedures:

- NA

##### D. Honesty policy regarding cheating, plagiarism, misbehavior:

- Participation in cheating will lead to applying all following penalties together
  - Failing the subject he/she cheated at
  - Failing the other subjects taken in the same course
  - Not allowed to register for the next semester. The summer semester is not considered as a semester.

**E. Grievances Policy:**

- According to the general policies applied at the University of Jordan for grievance, when there is a complaint or conflict between a student and an academic/staff member or another student, the following procedures must be followed:
  - The student writes a formal complaint describing the situation of conflict to the Dean of the School or the President of the University.
  - Dean or President will first try to resolve the controversy by meeting/listening to both parties.
  - If agreement was not possible, Dean or president forms an investigation committee which will follow, within a specified timeline, the general policies for relevant circumstances.
- The following points are considered:
  - The committee will meet/talk to both parties and witnesses (if applicable) within two weeks of conflict.
  - All meetings and discussions are documented according to the university policies.
- Results/ recommendations will be sent to the Dean or President who is responsible for their implementation

**F. Grading policy:**

- Semester Works (presentation, assignment, and quizzes): 30 Points
- Midterm Exam: 30 Points.
- Final Exam: 40 Points.

**G. Available university services that support achievement in the course:**

An account on MS teams, library, internet connection, E-Learning.

**27. References:****A- Required book(s), assigned reading and audio-visuals:**

1. Wilson and Gisvold's text book of Organic, Medicinal and Pharmaceutical Chemistry; Delgado, J.N.; Remers, W.A., Lippincott-Raven press, Philadelphia, 10th Ed. (1998). (Text book)
2. Principles of Medicinal Chemistry, 4th Edition. Foye, W.O.; Lemke, T.L.; Williams, D.A.
3. An Introduction to Medicinal Chemistry, 3rd edition; Graham L. Patrick; Oxford University Press Inc., New York, 2005  
Pharmacophore and Pharmacophore searches, 2006, Therry Langer and Remi Hoffmann

**B- Recommended books, materials, and media:**

4. Burger's Medicinal Chemistry and Drug Discovery, Dr. Alfred Burger's, Sixth Edition, 2002. six volumes: 1-6S



5. Selected Journals in medicinal chemistry: A list will be provided.

**28. Additional information:**

Name of the Instructor or the Course Coordinator: Prof.Dr. Yusuf Al-Hiari.....	Signature: 	Date: 11/13/2024 .....
Name of the Head of Quality Assurance Committee/ Department .....	Signature: .....	Date: .....
Name of the Head of Department .....	Signature: .....	Date: .....
Name of the Head of Quality Assurance Committee/ School or Center .....	Signature: .....	Date: .....
Name of the Dean or the Director .....	Signature: .....	Date: .....