مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	Phytochemical analysis
2	**Course number**	1201427
3	**Credit hours**	2 (theory)
	Contact hours (theory, practical)	2 theory hr and separate 3 hr practical course per week
	Course Level /Hours according to Jordan National Qualifications Framework (JNQF) Standards	7th/80 hr
4	**Prerequisites/corequisites**	(Prerequisite 1201315+ 1201425)
5	**Program title**	BSc. Pharmacy
6	**Program code**	--
7	**Awarding institution**	The University of Jordan
8	**School**	Pharmacy
9	**Department**	Pharmaceutical Sciences
10	**Course level**	Undergraduate
11	**Year of study and semester (s)**	First semester of the 4th year
12	**Other department (s) involved in teaching the course**	N/A

13	**Main teaching language**	English
14	**Delivery method**	☑ Face to face learning ☐ Blended ☐ Fully online
15	**Online platforms(s)**	☑Moodle ☑Microsoft Teams ☐Skype ☐Zoom
16	**Issuing/Revision Date**	1/11/2023

17 Course Coordinator:

Name: Prof. Mohammad Hudaib
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18 Other instructors:

Name: N/A Office number: Phone number: Email: Contact hours:

19 Course Description:

From plants to drug is the main goal of this course. It will deal with all the aspects of preparation and analysis of natural products (drugs, dietary supplements, or nutraceuticals preparation). This will include topics of plant selection, collection strategies, plant identification and sample preparation, as well as extraction, separation, and identification. Advanced extraction methods and modern methods of chromatography will also be covered. Quality control of herbal drugs: identification and characterization of main phytochemical groups will be discussed leading to file registration according to local, regional, and international administrations.

20 Course aims and outcomes:

A- Aims:

- To describe the methods used in drug discovery and QC of natural products (herbal drugs and nutraceuticals)
- To understand the analytical methods used in QC of herbal drugs and preparations
- To provide the students with all information regarding natural-herbal products analysis
- To recommend the most appropriate analytical methods used in production of drugs based on natural sources

B- Students Learning Outcomes (SLOs):

Upon successful completion of this course, students will be able to:

Discriptors	CLO No.	SLOs of the program: Program Learning Outcomes (PLOs) / SLOs of the course: Course Learning Outcomes (CLOs)	Learner	Problem-Solver	Communicator	Professional
Knowledge	K1	Define knowledges from foundational sciences into applicable analytical tools.				
	K2	Recall facts, terms, basic concepts, and information regarding selection, preparation, and production of natural products (e.g., nutraceuticals, dietary supplements, and herbs).				
Skills	S1	Identify problems associated with herbal drugs analysis.				
	S2	Figure out best method for QC of herbal drugs.				
	S3	Describe different chromatographic and spectroscopic methods used in QC of herbal preparations.				
Competencies	C1	Demonstrate **integrity**, by not cheating and not committing plagiarism, and **respect to** tutors and classmates by observing active listening inside the classroom and by complying with tutor's instructions and relevant university regulations				

21. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
1	1.1	**Introduction and Concepts (Course Contents, Objectives, ILOS, and Assessments)**	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	1.2	**Introduction and Concepts (Phytochemical Analysis: What, Why and How)**	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
2	2.1	**Introduction and Concepts (Drug Discovery and QC):** **Generalities**	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	2.2	**Introduction and Concepts (Drug Discovery and QC):**	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
		Approaches and Strategies						
3	3.1	**1. Plant Selection Strategies for Drug Discovery** a. Random selection b. Ethnopharmacology c. Chemotaxonomy d. Geographical e. Computer-based selection methods f. Literature information selection technique (LIST	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	3.2	**Plant Collection and Identification**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	3.3	**Sample preparation (drying, garbling, powdering, etc..)**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	
4	4.1	**Extraction of natural products** a. Principles and Applications	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
	4.2	b. Methods of extraction	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
5	5.1	**c.** Solvent extraction (efficiency and pH-dependence	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	5.2	d. Distillation, Soxhlet, etc…	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
6	6.1	e. SFE (types of super critical fluids, advantages, and applications)	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	6.2	Galenical preparations and other extraction methods	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
7	7.1	**Separation Techniques, Centrifugation, Distillation, Crystallization, Filtration, and Extraction**	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
	7.2	**Chromatography** **a. Principle** **b. Classifications** **c. Types of chromatography** **d. Quantitative and Qualitative methods** **e. PC, TLC, CC, IEC, SEC**	K1-K2	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
8-10	8-9.1	**Chromatography:** **HPLC application in QC of herbal drugs**	S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	10.1	**Chromatography:** **GC, GC/MS application in QC of herbal drugs**	S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	11.1	**Plant Primary Metabolites (Identification and Analysis-1):** **Sugars and Lipids**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
11-12	11.2	**Plant Secondary Metabolites (Identification and Analysis-1)** **a. Alkaloids** **b. Flavonoids** **c. Glycosides**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	12.1	**Plant Secondary Metabolites (Identification and Analysis-2)** **d. Phenolic compounds** **e. Saponins** **f. Volatile oils**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
13	13.1	**Quality control** **of Herbal Products** **(Raw material, I.P., and Finished)**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	13.2	**Quality control** **Of herbal drugs**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
		Finished Product QC (solid dosage forms)						
14	14.1	**Standardization of herbal drugs Selected examples on Compendium monographs for common natural products and medicinal plants-1.**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts
	14.2	**Biological assays of natural drugs (Brine shrimp, Potato disc,**	K1-K2 S1-S3	Face to Face	Lecturing		Quiz (Exam)	Textbook, References, handouts

Week	Lecture	Topic	Student Learning Outcome (CLOs)	Learning Methods (Face to Face/Blended/ Fully Online)	Teaching Methods/ platform	Synchronous / Asynchronous Lecturing	Evaluation Method	Resources
		Antimicrobial Activity Evaluation).						
15	15.1	**- Practical Examples and Surveys** **- Assignment and Discussion**	S1-S3 C1	Blended	Seminar Teams		Assignment	Literature

22 Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	CLOs	Period (Week)	Platform
Quiz	10	Topics 1-3	K1-K2, S1-S3, C1	5th week	On campus
Midterm Exam	30	Topics 1-7	K1-K2, S1-S3, C1	8th week	On campus
Assignment	10	TBC	K1-K2, S1-S3, C1	14th week	On campus
Final Exam	50	All	K1-K2, S1-S3, C1	16th week	On campus

23 Course Requirements

Students should have:

- Computer
- Internet connection
- Active university account on Moodle (e-learning) website
- Active university account on Microsoft Teams

24 Course Policies:

A- Attendance policies: As per the applicable university regulations

B- Absences from exams and handing in assignments on time: As per the applicable university regulations

C- Health and safety procedures: N/A

D- Honesty policy regarding cheating, plagiarism, misbehavior: As per the applicable university regulations

E- Grading policy:

- Midterm exam (30%)
- Course work- Assignment & Quiz (20%)
- Final exam (50%)

F- Available university services that support achievement in the course:

- Moodle (e-learning) website
- Microsoft Teams institutional subscription

25 References:

A- Required book(s), assigned reading and audio-visuals:

- General references of Phytochemical Analysis, e.g.:
- Phytochemical Methods A Guide to Modern Techniques of Plant Analysis. By A.J. Harborne (Springer Netherlands, 3rd edition-1998)…… **Text Book 1**
- Plant Drug Analysis, A Thin Layer Chromatography Atlas. By H. Wagner, S. Bladt, ed., Springer-Verlag, New York, NY, 1996……**Text Book 2**

B- Recommended books, materials, and media:

- General references of Drug Discovery Approaches, e.g.:
- Katiyar C., Kanjilal S., Gupta A., Katiyar S. Drug discovery from plant sources: an integrated approach. Ayu. 2012;33(1): 10–19;
- Journal of Ethnopharmacology.
- General references of Instrumental and Chemical Analysis, e.g.:
- Principles of Instrumental analysis. D. Skoog
- Pharmaceutical Analysis. K. Conners
- Undergraduate instrumental analysis. James W. Robinson
- Pharmaceutical Analysis. D. Watson
- The Analysis of Drugs in Biological Fluids. J. Chamberlain
- BP, USP, EP
- ICH Guidelines (Validation of Analytical Procedures), Q2(R1).ICH: 2005.

URL: (http://www.ich.org/products/guidelines/quality/quality-single/article/validation-of-analytical-procedures-text-and-methodology.html)

- Herbal pharmacopoeias (e.g. GCE Monographs, WHO monographs, BHP, AHP)
- Medicinal Natural Products, Third edition; 2009. Paul M. Dewick, Wiley Publication (JU e-library, EBSCO, MEDLIN E, ISI web of knowledge, Science direct)
- Pharmaceutical Analysis, David Watson, Second Edition.
- Pharmacognosy, Phytochemistry, Medicinal Plants (by Jean Bruneton)

26 Additional information:

Name of Course Coordinator: **Prof. Mohammad Hudaib;** Signature: Mohammad Hudaib; Date: **1/11/2023**
Head of Curriculum Committee/Department: ---------- Signature: ----------
Head of Department: ---------- Signature: ----------
Head of Curriculum Committee/Faculty: ---------- Signature: ----------
Dean: ---------- Signature: ----------