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| **1** | **Course title** | Phytochemistry 2 |
| **2** | **Course number** | 1201425 |
| **3** | **Credit hours** | 2 |
| **Contact hours (theory, practical)** | 2 |
| **4** | **Prerequisites/corequisites** | Phytochemistry 1 |
| **5** | **Program title** | B.Sc. Pharmacy |
| **6** | **Program code** | 120 |
| **7** | **Awarding institution**  | Pharmacy |
| **8** | **School** | Pharmacy |
| **9** | **Department** | Pharmaceutical Sciences |
| **10** | **Level of course**  | 4 |
| **11** | **Year of study and semester (s)** | 4/1 |
| **12** | **Final Qualification** | BSc in Pharmacy |
| **13** | **Other department (s) involved in teaching the course** | None |
| **14** | **Language of Instruction** | English |
| **15** | **Teaching methodology** | [x] Blended [ ]  Online [ ] In Campus |
| **16** | **Electronic platform(s)** | [ ] Moodle [x]  Lecturing in campus / Microsoft teams [ ] Skype [ ] Zoom [x] Others: in campus |
| **17** | **Date of production/revision** | 10th October 2021 |

**18 Course Coordinator:**

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| Name: Professor Mayadah ShehadehOffice number: 207 extension building Phone number: JU Ext 23313Email: m.shehadeh@ju.edu.jo |

**19 Other instructors:**

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| Name: Office number:  **NONE**Phone number: Email:  |

**20 Course Description:**

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| The biosynthesis, isolation and identification of the secondary plant constituents and discussion of natural drugs containing these constituents constitute the programmer of the Pharmacognosy II lectures in the 2rd and 3th year. During Phytochemistry II lectures, plant constituents biosynthesized via mevalonic acid pathway and nitrogenous secondary metabolites will be discussed.The aim of the lectures is not to rely just on factual information but to impart an understanding of natural products structures and the way they are put together by living organisms. |

**21 Course aims and outcomes:**

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| A- Aims:The aim of the lectures is not to rely just on factual information but to impart an understanding of natural product structures and the way they are put together in living organisms which is the basis of the co-existence and interaction in the nature.1. Current updated information of the biosynthetic pathways of the mevalonic acid originated substances. Terpenes and alkaloids will be discussed.
2. Origin and isolation / identification methods of bioactive substances belonging to these pathways
3. Therapeutic and toxicological activities of these substances
4. Chemical ecology of these substances

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course, students will be able to:1) To know the potentially useful medicinal plants of these pathways2) To know the importance and value of ethnopharmacology in drug discovery3) To study the biosynthesis of secondary metabolites and major biosynthetic pathways4) To know the Latin and bilingual (English/Arabic) common names of potentially used medicinal plants5) To know examples of commonly misused natural drugs and their semisynthetic/synthetic derivatives /analogues6) To use different references to collect the necessary information7) To know and to correlate the mechanisms, concepts and principles of biosynthetic pathways in plants8) To expand the horizon of the organic chemistry9) To apply the fundamental principles of organic chemistry and biochemistry for construction of natural products10) To predict the physico-chemical properties of natural products11) To evaluate the plant/plant, plant/animal and plant/insect interactions based on the secondary plant constituents |

**22. Topic Outline and Schedule:**

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| **Week** | **Lecture** | **Topic** | **Teaching Methods\*/platform** | **Evaluation Methods\*\*** | **References** |
| 1 | 1.1 | Terpenes General | Lecturing in campus / Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products |
| 1.2 |  Biosynthetic Pathway |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter **5** |
| 1.3 | Chemistry of Terpenes  |  Lecturing in campus / Microsoft teams   |  Seminar | Medicinal Natural Products Chapter **5** |
| 2 | 2.1 |  Monoterpenes and phenyl propenes - rich volatile oils  |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter **5 & 4** Volatile oils Chapter 4 (Table 4.1) |
| 2.2 |  Plants containing \* Monoterpenes-rich volatile oils\* Irregular monoterpenes\* Irridoids |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter **5** |
| 2.3 |  Plants containing Sesquiterpenes |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 5 |
| 3 | 3.1 |  Plants containing Diterpenes |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 5 |
| 3.2 |  Plants containing Triterpenes |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter5 |
| 3.3 | **Quiz -1** | **In Campus** | **Quiz – 1 Wednesday, 3rd November 2021** | Volatile Oils  |
| 4 | 4.1 |  Plants containing Steroids |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter 5 |
| 4.2 | Plants containing Cardiac Glycosides |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 5 |
| 4.3 |  Plants containing Triterpenes |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 5 |
| 5 | 5.1 |  Plants containing Tetraterpenes |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 5 |
| 5.2 |  Applications |   Lecturing in campus / Microsoft teams |  Home work | Internet |
| 6 | 6.1 | Alkaloids  |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 6.2 |  General Introduction |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 6.3 |  Alkaloids extraction |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 7 | 7.1 | Alkaloids derived from ornithine (Atropine and Cocaine)  |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 7.2 |  Alkaloids derived from ornithine 2  |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 7.3 | Cocaine Addiction |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 8 | 8.1 | Cocaine Synthetic analogue |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter 6 |
| 8.2 | Atropine Analogue |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter 6 |
| 8.3 | Atropine toxicity |   Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter 6 |
| 9 | 9.1 |  Alkaloidal amines-1 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 9.2 |   Alkaloidal amines-2 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 9.3 |  Applications |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| Quiz 2 | Introduction to Alkaloids  | **In Campus** | **Quiz-2 Wednesday 29th December 2021** | **Introduction to alkaloids** |
| 10 | 10.1 |  Isoquinoline alkaloids |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 10.2 |  Isoquinoline alkaloids |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 10.3 | Isoquinoline alkaloids |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 11 | 11.1 | Isoquinoline alkaloids |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 11.2 |  Quinoline Alkaloids |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 11.3 |   Indole alkaloids-1 |   Lecturing in campus / Microsoft teams |  | Medicinal Natural Products Chapter 6 |
| 12 | 12.1 |   Indole alkaloids-2 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 12.2 |   Indole alkaloids-3 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 12.3 |  Alkaloids derived from lysine-1 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 13 | 13.1 |  Alkaloids derived from lysine-2 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 13.2 |  Alkaloids derived from lysine-3 |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 13.3 | Pseudo alkaloids |   Lecturing in campus / Microsoft teams | Seminar | Medicinal Natural Products Chapter 6 |
| 14 | 14.1 |   Purine alkaloids |  Lecturing in campus / Microsoft teams |  Seminar | Medicinal Natural Products Chapter 6 |
| 15-16 |  | Final Exam | **In Campus** | Final Exam |  |

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* Teaching methods include: Synchronous lecturing/meeting; Asynchronous lecturing/meeting
* Evaluation methods include: HomeWorks, Quizzes, Exams.

**23 Evaluation Methods:**

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

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| **Evaluation Activity** | **Mark** | **Topic(s)** | **Period (Week)** | **Platform** |
| Quiz 1 | 7.5 | Terpenes  | 4 | **In campus** |
| Quiz 2  | 7.5 |  Alkaloids | 9 | **In campus**  |
| Home work 1 | 2.5 | Terpenes  | 4 | Microsoft teams Assignments |
| Home work 2  | 2.5 |  Alkaloids | 8 |  Microsoft teams Assignments |
| Midterm Exam | 30 | Terpenes | 5-6 | **In campus**  |
| Final Exam  | 50 | Alkaloids and terpenes  | 14 | **In campus**  |

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**24 Course Requirements (e.g. computer, tablet, iPad, Smart phone, internet connection, webcam, account on a specific software/platform)**

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| **Students should have a computer, tablet, iPad, Smart phone, internet connection, webcam, account on a specific software/platform****A hard or electronic copy of the text book (Dewick 3rd Edition)** |

**25 Course Policies:**

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| 1. Attendance policies: obligatory

**University rules and regulations are applied*****First warning*** – with 4 absences***Last warning*** – with 5 absences**Failing in the subject** – with 6 absencesB- Absences from exams and handing in assignments on time:Will result in zero achievement unless health report or other significant excuse is presented.C- Health and safety procedures: **N/A**D- Honesty policy regarding cheating, plagiarism, misbehavior:According to JU regulations participation, commitment of cheating will lead to applying all following penalties together1) Failing the subject he/she cheated at2) Failing the other subjects taken in the same course3) Not allowed to register for the next semester. The summer semester is not considered as a semesterE- Grading policy:Exams and Quizzes. Quizzes 15 Assignments 5 Midterm 30 Final Exam: 50 marksTotal 100 marksF- Available university services that support achievement in the course: E-library, internet connection, teams platform, JU exams platform, E-learning platform.  |

**26 References:**

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| A- Required book(s), assigned reading and audio-visuals:1. Medicinal Natural Products, **Third edition**; **2009**. Paul M. Dewick, Wiley Publication2.(JU e-library, EBSCO, MEDLIN E, ISI web of knowledge, Science direct) B- Recommended books, materials and media:- Pharmacognosy (V. E. Tyler)- Trease and Evan's Pharmacognosy, 16th Edition; 2009, William C.Evans, Saunders Ltd.- Pharmacognosy, Phytochemistry, Medicinal Plants , Second edition (by Jean Bruneton)  |

**27 Additional information:**

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| **Course Material and Announcements:** Students need to use the e-learning page at the JU website in order to get all lecture handouts and guidelines which will be uploaded there. In addition, course related announcements and exam results will be posted on the e-learning page and **it is the responsibility of each student to check the site regularly**.Username and password to access the course on the e-learning page will be provided to students in the beginning of the semester.**Grievance 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:1. The student writes a formal complaint describing the situation of conflict to the Dean of the School or the President of the University.
2. Dean or President will first try to resolve the controversy by meeting/listening to both parties.
3. 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:

a.       The committee will meet/talk to both parties and witnesses (if applicable) within two weeks of conflict.b.      All meetings and discussions are documented according to the university policies.c.       Results/ recommendations will be sent to the Dean or President who is responsible for their |

Name of Course Coordinator: Prof. Mayadah Shehadeh Signature: 

Date: 10/10/2021

Head of Curriculum Committee/Department: ---------------------------- Signature: --------------------------

Head of Department: ------------------------------------------------------------ Signature: -----------------------

Head of Curriculum Committee/Faculty: ---------------------------------------- Signature: -------------------

Dean: ---------------------------------------------------------- Signature: -------------------------------------------