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| **1** | **Course title** |  Biopharmaceutics |
| **2** | **Course number** | 1203471 |
| **3** | **Credit hours** | 2 theoretical hours |
| **Contact hours (theory, practical)** | 2 theoretical hours |
| **4** | **Prerequisites/corequisites** | 1202235 |
| **5** | **Program title** | BSc Pharmacy, PharmD |
| **6** | **Program code** |  |
| **7** | **Awarding institution**  | The University of Jordan |
| **8** | **School** | Pharmacy |
| **9** | **Department** | Biopharmaceutics and Clinical Pharmacy |
| **10** | **Level of course**  | 4th year |
| **11** | **Year of study and semester (s)** | First |
| **12** | **Final Qualification** | BSc Pharmacy, PharmD |
| **13** | **Other department (s) involved in teaching the course** | None |
| **14** | **Language of Instruction** | English |
| **15** | **Teaching methodology** | ☐Blended ☑Online |
| **16** | **Electronic platform(s)** | ☑Moodle ☑Microsoft Teams ☐Skype ☐Zoom ☐Others………… |
| **17** | **Date of production/revision** | 4.october.2021 |

**18 Course Coordinator:**

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| Name: Dr. Mariam Abdel JalilOffice number: 109Phone number: 23304Email: m.abdeljalil01@ju.edu.jo |

**19 Other instructors:**

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| Name: Rana Abu-Dahab, Prof.Office number: 133Phone number: 23353Email: abudahab@ju.edu.jo |

**20 Course Description:**

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| As stated in the approved study plan.Biopharmaceutics is a core course that handles the effects of various physicochemical properties of drugs and drug products on their bioavailability. It covers the potentials as well as barriers for different routes of drug administration.The course introduces the importance of proper *in vitro* testing for better simulation of the *in vivo* drug administration. |

**21 Course aims and outcomes:**

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| A- Aims:* To Identify the extracellular and cellular barriers for the absorption of conventional drugs as well as for biotechnology products .
* To be able to discuss of the effect of physicochemical properties and dosage form design on the bioavailability of drugs after extravascular administration.
* To define the different routes of drug administration and illustrate in each case the histologic and anatomic properties specific to that route

B- Intended Learning Outcomes (ILOs): **Upon successful completion of this course students will be able to** 1) Recall the physiological and anatomical aspects involved in drug permeation across different barriers2) List different routes of drug administration and the potentials each route furnishes for the delivery of different drug molecules3) Define the physicochemical and formulation factors that influence drug penetration through each delivery route4) Outline the criteria needed to be evaluated for in vitro test system regarding each route of drug delivery5) Compare and contrast the opportunities and limitations of each drug delivery route6) Choose the proper route of administration for specific drug molecule7) Identify the barriers for novel drug molecules/formulations8) Distinguish the important physicochemical properties of drug and drug product needed for efficient delivery across a specific barrier9) Differentiate between the different barriers for drug absorption and be able to recommend one/some for efficient delivery of a certain drug molecule10) Choose delivery routes for drugs with different physicochemical properties11) Demonstrate integrity by not cheating and not committing plagiarism12) Demonstrate respect to professors and classmates by observing active listening inside the classroom |

**22. Topic Outline and Schedule:**

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| **Week** | **Topic** | **Teaching Methods\*/platform** | **Instructor** | **Self-study method** | **References** |
| 1 | Introduction to course outline | Teams | Dr. Mariam Abdel Jalil |  |   |
| Introduction to biopharmaceutics | Teams/Moodle | Dr. Mariam Abdel Jalil | Forum | Main reference |
| 2 | Bioavailability | Teams/Moodle | Dr. Mariam Abdel Jalil |  | Main reference |
| **Drug Absorption**Physiologic factors related to drug absorption: cell membrane  | Teams/Moodle | Dr. Mariam Abdel Jalil |  | Physiological Pharmaceutics |
| 3 | Mechanisms of drug transport across membranes | Teams/Moodle | Dr. Mariam Abdel Jalil |  |  |
|  Models for assessing drug permeability (in vitro) |  |  | Video embedded self-assessment quiz |  |
|  |  Oral drug absorption: anatomic and physiologic considerations | Teams/Moodle | Dr. Mariam Abdel Jalil |  |  |
| 4 |  Effect of food and disease on gastric emptying | Teams/Moodle | Dr. Mariam Abdel Jalil |  | Main reference and Physiological Pharmaceutics |
|  | Physicochemical factors that influence drug absorption: pH partition hypothesis | Teams/Moodle |   Dr. Mariam Abdel Jalil | Forum | Main reference and Physiological Pharmaceutics |
| 5 |  Physicochemical factors that influence drug absorption. | Teams/Moodle | Dr. Mariam Abdel Jalil |  | Aulton's Pharmaceutics and main reference |
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| 6 | Physicochemical factors that influence drug absorption | Teams/Moodle | Dr. Mariam Abdel Jalil |  | Aulton's Pharmaceutics and main reference |
|  BCS 1 | Teams/Moodle | Dr. Mariam Abdel Jalil  | Video embedded self-assessment quiz | Biopharmaceutical classification system: A strategic tool for oral drug delivery technology  |
|  | Dissolution testing 1 | Teams/Moodle |  Prof. Rana Abu-Dahab |  | Book chapter from Biopharmaceutics Applications in Drug Development |
| 7 | Dissolution testing 2 | Teams/Moodle |  Prof. Rana Abu-Dahab | Self-learning materials: compare and contrast Dissolution testing of different dosage form and correlate with the biological barrier |  |
| 8 | In vitro in vivo correlation | Teams/Moodle |  Prof. Rana Abu-Dahab |  |   |
|  | Drug absorption via the lung 1 | Teams/Moodle |  Prof. Rana Abu-Dahab |  |  Review articles” Inhaled nano- and microparticles for drug delivery |
| 9 | Drug absorption via the lung 2 | Teams/Moodle |  Prof. Rana Abu-Dahab | Homework: systemic delivery via the lung: example and rational |   |
|  | Drug absorption via the skin 1  | Teams/Moodle |  Prof. Rana Abu-Dahab |  | Physiological Pharmaceutics |
| 10 | Drug absorption via the skin 1 | Teams/Moodle |  Prof. Rana Abu-Dahab |  |   |
| Buccal drug absorption | Teams/Moodle |  Prof. Rana Abu-Dahab |  |  Review article: Buccal absorption of peptides and proteins |
| 11 | Nasal drug absorption  | Teams/Moodle |  Prof. Rana Abu-Dahab | Forum: compare and contrast the barriers to drug absorption | Physiological Pharmaceutics |
|  | Parenteral drug absorption | Teams/Moodle |  Prof. Rana Abu-Dahab |  |  Main reference |
|  | Drug Targeting  | Teams/Moodle |  Prof. Rana Abu-Dahab |  |  Passive and Active Drug Targeting: Drug Delivery to Tumors as an Example |
| 12 | Biopharmaceuticals | Teams/Moodle |  Prof. Rana Abu-Dahab | Homework: approved biopharmaceuticals in the last 5 years. Product and Indication | Pharmaceutical Biotechnology: Book chapter |
| 13 | Wiki discussions |
|  14 |  FINAL EXAM |   |    |  |   |

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* Teaching methods include: Synchronous lecturing/meeting; Asynchronous lecturing/meeting
* Evaluation methods include: Homework, Quiz, Exam, pre-lab quiz…etc

**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** |
|  **Quizzes** |  15 | To be announced |  |  |
| Quiz1 | 5 | To be announced | Week 3 | Microsoft forms |
| Quiz 2 | 5 | To be announced | Week 5 | Microsoft forms |
| Quiz 3 | 5 | To be announced | Week 7 | Microsoft forms |
| Quiz 4 | 5 | To be announced | Week 10 | Microsoft forms |
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| Wiki  | 10 | To be announced at week 3 to be submitted at week 12 |  | Moodle |
| Self-assessment quiz/forums | 5 | - |  | Moodle |

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

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| All students should have a computer, internet connection, a microphone and a webcam  |

**25Course Policies:**

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| A- Attendance policies: Students are allowed up to 4 absences B- Absences from exams and handing in assignments on time:* Midterm quiz: a justified excuse should be submitted and accepted by the instructor in order to be eligible for a makeup.
* Final Exam: a justified excuse should be submitted and accepted by the Dean in order to be eligible for and "incomplete" exam.

C- Health and safety procedures:D- Honesty policy regarding cheating, plagiarism, misbehavior:The participation, the commitment of cheating, plagiarism or misbehavior will lead to applying all following penalties together1. Failing the subject he/she cheated at
2. Failing the other subjects taken in the same course
3. Not allowed to register for the next semester

The summer semester is not considered as a semester. |

1. **References:**

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| 1. Required book (s), assigned reading and audio-visuals:
2. Applied biopharmaceutics and pharmacokinetics, Shargel and Yu, 7th edition, 2016, McGraw-Hill Medical, ISBN-10 : 0071830936 (Main reference)
3. Additional book (s), assigned reading and audio-visuals:
4. Aulton's Pharmaceutics Michael Aulton and Kevin Taylor, 5st edition, 2018
5. Physiological Pharmaceutics: Barriers to Drug Absorption,   Neena Washington, Clive Washington, Clive Wilson, 2nd edition, Taylor and Francis, 2001. ISBN: 0-748-40610-7
6. Essentials of Biopharmaceutics and Pharmacokinetics, Ashutosh Kar, 2011, Elsevier. ISBN: 978-81-312-2639-1
7. Principles and applications of biopharmaceutics and pharmacokinetic, Tipnis & Bajaj, 2008. Career Publications, ISBN: 9788188739141
8. Biopharmaceutics Applications in Drug Development, Rajesh Krishna , Lawrence Yu, 2008, ISBN10 0387723781
9. Passive and Active Drug Targeting: Drug Delivery to Tumors as an Example Torchilin V.P. (2010). In: Schäfer-Korting M. (eds) Drug Delivery. Handbook of Experimental Pharmacology, vol 197. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-00477-3\_1
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**27 Additional information:**

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Name of Course Coordinator: -----------------------------------Signature: ------------------ Date: ------------

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

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

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

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