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| **1** | **Course title** | Selected topics in Pharmaceutical Microbiology |
| **2** | **Course number** | 1202541 |
| **3** | **Credit hours** | 2(theory) |
| **Contact hours (theory, practical)** | 2 (theory) |
| **4** | **Prerequisites/corequisites** | 1202441 (Pharmaceutical Microbiology I I) |
| **5** | **Program title** | BSc in Pharmacy  |
| **6** | **Program code** | N/A |
| **7** | **Awarding institution**  | The University of Jordan |
| **8** | **School** | School of Pharmacy |
| **9** | **Department** | Pharmaceutics and Pharmaceutical Technology |
| **10** | **Level of course**  | Undergraduate |
| **11** | **Year of study and semester (s)** | Second semester of the 5th year |
| **12** | **Final Qualification** | BSc in Pharmacy  |
| **13** | **Other department (s) involved in teaching the course** | N/A |
| **14** | **Language of Instruction** | English |
| **15** | **Teaching methodology** | [ ] Blended [x] Online |
| **16** | **Electronic platform(s)** | [x] Moodle [x] Microsoft Teams [ ] Skype [x] Zoom [ ] Others………… |
| **17** | **Date of production/revision** | 9/10/2020 |

**18 Course Coordinator:**

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| Name: **Prof. Rula M. Darwish**Phone number: +962-6-5355000 (Ext. 23327)Email: rulad@ju.edu.jo  |

**19 Course Instructors:**

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**20 Course Description:**

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| In this course students will learn in more details the mechanisms of resistance to antimicrobials, whether inherent or acquired & how to limit it. In addition the students will study specific form of microbial resistance, the microbial biofilms. On the other hand, students will learn the use of microorganisms in pharmaceutical industry for the production of antibiotics, vaccines, immunological products & many other products. Also the students will be introduced to diagnostic tests & assays in which microorganisms or their products are major constituent in them. |

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**21 Course aims and outcomes:**

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| A- Aims:-      The student will understand microbial resistance including microbial biofilms and policies used to control hospital acquired infections 2-      To introduce the students to the principles of use of antibiotics3-      The student will be familiar with microbial quality control.4-      The use of microorganisms in pharmaceutical Industry including fermentation, genetic engineering & other pharmaceutical products**B- Intended Learning Outcomes (ILOs):**Successful completion of the course should lead to the following outcomes:A. Knowledge and Understanding: A1- The student will know the principle of microbial resistance and understands different policies used to control this problemA2- The student will know the formation of microbial biofims & their medical impactA3- The student will know how antibiotics are synthesized by fermentation & the good manufacturing practices implemented in manufacturing areasA4- The student will know the methods of preparing vaccines & different immunological products & their quality control testsA5- The students will understand the basics of pharmaceutical biotechnology & their application in manufacture of some hormones & in diagnosis of infectious diseasesA6- The student will be introduced to different applications of microorganisms in pharmaceutical industry (manufacture of products, assays, diagnosis)A7- The student will be introduced to the rationale of different antibiotic use policies applied in hospitalsB. Intellectual, Analytical and Cognitive Skills: Student is expected to B1- Design policies to limit drug resistance in hospitalsB2- Implement GMP for fermentation processB3- Set different quality control tests to immunological productsB4- Set & implement antibiotic use policy in the hospitalB5- Analyse & interpret the results of antibiotic assay & screening of mutagenicityC. Subject-Specific Skills: Student is expected toC1- Design a suitable antibiotic use policyC2- Design proper quality control parameters to monitor fermentation processC3- design suitable quality control procedures for the manufacture of vaccines & immunological productsC4-Interpret the results of PCR & DNA hybridization for the diagnosis of infectious diseasesC5- Design a suitable assay method for antibiotics & for screening to mutagensD. Transferable Key Skills: Students is expected to D1- Communicate effectively with the antibiotic manufacturer bodies concerning GMP D2- Communicate effectively with infection control committees in hospitals for setting antibiotic policiesD3- Communicate effectively with clinical laboratories & physicians regarding the diagnosis of infectious diseasesD4- Interact with regulatory authorities regarding microbial assaysProgram Competencies Achieved: Identify drug resistance and its constrains on treatment Assess methods of transfer of drug resistances and correlate them with antibiotic useIdentify medical problems associated with biofilms Identify basis of fermentationDesign methods for production of antibiotics by fermentation processIdentify problems related to GMP from microbiological point of viewAssess methods for manufacturing of vaccines bacterial & viral Ability to apply quality control on vaccines Assess methods for production of immune sera- Ability to apply quality control on immune seraApplications of biotechnology in pharmaceuticals & in diagnosis of infectious diseases (PCR & DNA hybridization)Applications of biotechnology in pharmaceuticals & in diagnosis of infectious diseases (PCR & DNA hybridization) 2.17 Advise patients and other health professionals on proper usage of medicines including their strength, frequency, dosage form and route of administration |

**22. Topic Outline and Schedule:**

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| **Week** | **Lecture** | **Topic** | **Teaching Method****(Platform)** | **Evaluation****Methods** | **Reference** |
| 1 | 1.1 | Introduction bacterial resistance to antibiotics | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam | Denyer, S. P., N. A. Hodges, S. P. Gorman, and B. F. Gilmore. Hugo and Russell's PharmaceuticalMicrobiology. Wiley-Blackwell, UK; 8th Edition. (2011) |
| 1.2 | Synchronous (MS Teams) |
| 2 | 2.1 | Mechanisms of resistance | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 2.2 | Synchronous (MS Teams) |
| 3 | 3.1 | Biochemical mechanisms of resistance | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 3.2 | Synchronous (MS Teams) |
| 4 | 4.1 | Problem of bacterial resistance to antibiotics | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 4.2 | Synchronous (MS Teams) |
| 5 | 5.1 | Resistant Bacteria by Overuse & Misuse of Antibiotics- Use of antibiotic combinations | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 5.2 | Synchronous (MS Teams) |
| 6  | 6.1 | Biofilms | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 6.2 | Synchronous (MS Teams) |
| 7 | 7.1 | Fermentation | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 7.2 | Synchronous (MS Teams) |
| 8 | 8.1 | The manufacture of immunological products | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 8.2 | Synchronous (MS Teams) |
| 9  | 9.19.2 | Pharmaceutical biotechnology | Asynchronous (Moodle)Synchronous (MS Teams) |  |
| 10 | 10.1 | Other applications of microorganisms in pharmaceutical industry | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 10.2 | Synchronous (MS Teams |
| 11 | 11.1 | Biorisk Management | Asynchronous (Moodle) | Mid Exam /Presentation/Final Exam |
| 11.2 | Synchronous (MS Teams |
| 12 | 12.112.2 | Seminars | Synchronous MS Teams | Presentation |
| 13 | 13.113.2 | Seminars | Synchronous MS Teams | Presentation |
| 14 | 14.114.2 | Seminars | Synchronous MS Teams | Presentation |

**23 Course Requirements:**

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| Students should have:* Computer
* Internet connection
* Webcam
* Active university account on Moodle (e-learning) website
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**24 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**  | **Period** | **Platform** |
| Exam ( mid) | 30% | Week 7 | On Campus |
| Students’ reports  | 10% | Week 9-10  | Moodle |
| Students’ Presentation | 10% | Week 12-14  | Microsoft Teams |
| Final exam  | 50% | Week 15  | On Campus |

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**25 Course Policies:**

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| A- Attendance policies:As per the applicable university regulationsB- Absences from exams and submitting assignments on time:As per the applicable university regulationsC- Health and safety procedures:Health and safety procedures are detailed in the laboratory manual and will be discussed in the first practical session D- Honesty policy regarding cheating, plagiarism, misbehavior:As per the applicable university regulationsE- Grading policy:As described aboveF- Available university services that support achievement in the course:School laboratoriesMoodle (e-learning) website |

**26 References:**

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| A- Required book (s), assigned reading and audio-visuals:Hugo, W.B and Russell, A.D. Pharmaceutical Microbiology. Eighth Edition- Denyer, S. P., N. A. Hodges, S. P. Gorman, and B. F. Gilmore. Hugo and Russell's Pharmaceutical Microbiology. Wiley-Blackwell, UK; 8th Edition. (2011). - Adam Fraise, Jean-Yves Maillard & Syed Sattar. Principles and Practice of Disinfection, Preservation & Sterilization. Wiley-Blackwell, UK; 5th Edition (2013) - Michael J. Akers. Sterile Drug Products: Formulation, Packaging, Manufacturing and Quality. CRC Press; 1st Edition (2010) - Richard Schwalbe, Lynn Steele-Moore & Avery C. Goodwin. Antimicrobial Susceptibility Testing Protocols. CRC Press; 1st edition (2007)  |

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**27 Additional information:**

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Name of Course Coordinator: **Porf. Rula M. Darwish**  Signature: ------------------ Date: **8/10/2020**

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

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

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

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