



<b>Hashemite University</b>	 	<b>Bio-Reactors</b>
<b>Faculty of Science</b>		<b>3 Credit Hours</b>
<b>Department of Biology and Biotechnology</b>		<b>Pre-requisite: Biotechnology</b> <b>Second Semester 2018/2019</b>
<b>Course Syllabus</b>		

<b>Course Information</b>		
Course Title	<b>Bio-Reactors</b>	
Course Number	<b>0104424</b>	
Course Credits	<b>3 (2 credits theory + 1.5 credits of practical work)</b>	
Course Time		
Course Duration		
Prerequisite(s)		
Instructor	<b>Dr. Muhannad I. Massadeh</b>	
Office Location	<b>Department of Biological Sciences and Biotechnology</b>	
Office Phone	5047	
Office Hours		
E- mail	massadeh@hu.edu.jo	
Course Web Site:		
<b>Text Book</b>		
Title	Bioreactors for Tissue Engineering Principles, Design and Operation	
Author(s)	Chaudhuri, Julian.	
Publisher	Springer, Dordrecht	
Year	<b>2005</b>	
Edition		
References(s)	(2)- Solid-state fermentation bioreactors : fundamentals of design and operation. Springer, Berlin : 2006  (3)- Smith, J.E. (2004). <i>Biotechnology</i> . Cambridge University Press. UK.	
<b>Evaluation Policy</b>		
<b>Assessment Type</b>	<b>Expected Date</b>	<b>Weight</b>
First Exam		15%
Second Exam		15%
Other	LAB work + reports + Mid + final	5+5+10+ 10% respectively
Final Exam		40%

<b>Course Objectives</b>	
<ul style="list-style-type: none"> <li>- Classify bioreactor types</li> <li>- Explain the major differences among various bioreactor types and recognize the constraints of bioreactors.</li> <li>- Learn the different types of cultivations.</li> <li>- Be able to choose the right bioreactor configuration for a given cell culture conditions.</li> <li>- Explain the effects of manipulated variables (e.g. agitation rate, aeration rate etc) on cell growth and product formation</li> </ul>	

<b>Teaching and Learning Methods</b>	
<ul style="list-style-type: none"> <li>- Transparencies with head projector</li> <li>- Data show</li> </ul>	

<b>Course Contents</b>		
Week	Topics	Ch. no.
1-	<ul style="list-style-type: none"> <li>- Bioreactors in Biotechnology</li> <li>- Bioprocess Development</li> </ul>	1
2-	<ul style="list-style-type: none"> <li>- Cultivation Techniques: Submerged and Solid State cultivations</li> <li>- Basic concepts of bioreactor design</li> </ul>	2
3-	<ul style="list-style-type: none"> <li>- Selection of the bioreactor</li> <li>- Bioreactor design and operation: Upstream Processing</li> </ul>	4
4-	<ul style="list-style-type: none"> <li>- Bioreactor design and operation: Upstream Processing</li> <li>- Instrumentation and Control</li> </ul>	5
5-	<ul style="list-style-type: none"> <li>- Instrumentation and Control</li> <li>- Bioreactor preparation and use</li> </ul>	6
6-	<b><u>Lecture Exam I</u></b>	
7-	<ul style="list-style-type: none"> <li>- Aeration and Agitation</li> </ul>	8
8-	<ul style="list-style-type: none"> <li>- Heat Transfer Phenomena</li> <li>- Mass Transfer Phenomena</li> </ul>	
9-	<ul style="list-style-type: none"> <li>- Surface Bioreactors and their Characterization</li> </ul>	
10-	<ul style="list-style-type: none"> <li>- Downstream processing: Separation, Disintegration of cells, Extraction Methods, Purification and Drying.</li> </ul>	
11-	<b><u>Lecture Exam II</u></b>	
12-	Translation of Laboratory, Pilot, and Plant Scale Data	
13-	<ul style="list-style-type: none"> <li>- Applications of bioprocesses (SmF &amp; SSF).</li> <li>- Bioreactors in Industry: Present state of the Art, Trends of Further Development, Practical advice on the choice of bioreactors.</li> </ul>	
14-	<ul style="list-style-type: none"> <li>- <b>Case Study</b></li> </ul>	
15-	<b><u>Final Exam</u></b>	