UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

ENGINEERED CELLULAR SYSTEMS APPLICATIONS FOR THE PHARMACEUTICAL INDUSTRY

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	ING-IND/34 (INDUSTRIAL BIOENGINEERING)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	BIOENGINEERING
Curriculum	Cellule, tessuti e dispositivi
Year of study	2°
Period	1st semester (27/09/2021 - 21/01/2022)
ECTS	6
Lesson hours	75 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	PASQUALINI FRANCESCO (titolare) - 6 ECTS
Prerequisites	Good understanding of the English language. Students are expected to have a working understanding of the following key concepts (which will be briefly reviewed at the beginning of the course, anyway): Solid Mechanics Rigid-body mechanics and free-body diagrams Mechanics of deformable bodies Large deformation mechanics Fluid Dynamics Fluid statics Newtonian fluids Navier-Stokes equations Rheological analysis Dimensional analysis Statistical mechanics

	Internal energy Entropy Free Energy (Micro-)canonical ensemble Random walks
Learning outcomes	A recent trend in Pharmaceutical RnD is the validation of cell culture models that can help develop personalized therapies. Engineered cell culture platforms, such as organoids or organs-on-chips, can provide such predictive power and are good opportunities for students in biomedical engineering to enter the Biotech and Pharma job markets. In this advanced course, students will learn tissue engineering techniques to fabricate hearts-on-chips as well as computational and experimental strategies to characterize cell and tissue biomechanics on-chip. This course, which will be given by a faculty member recently returned from the Harvard University Wyss Institute (where organs-on-chips were invented), has the following objectives. To be familiar with the main applications in the pharmaceutical industry of: Mechanobiology Organs-on-chips To be capable of replicating experiments and analysis described in relevant scientific publications in the field To be able to critically evaluate scientific publications in this field To be able to communicate analytically and syntethically the progress in this field To be able to network with other experts in this field that will be involved with the course.
Course contents	Understanding drug RnD in Biotech and Pharma (7.5 hrs of lectures) Advanced notions of cell biology (7.5 hrs of lectures) Advanced notions in statistical and solid mechanics (7.5 hrs of lectures) Cardiac mechanobiology (7.5 hrs of lectures) How to measure cellular forces (22.5 hrs of lab activities) How to measure mechano-transduction (22.5 hrs of lab activities)
Teaching methods	Flipped classroom: Case studies (publications) Classroom discussion Laboratory activities
Reccomended or required readings	The core material will be provided by the instructor. Suggested reading: Jacobs, C. R. Introduction to Cell Mechanics and Mechanobiology. (ISBN-13: 978-0815344254) Nelson P. Biological Physics. Energy, Information, Life. (ISBN: 978-0578695471) Hang, J; Bocard, D; Peitisch M. C.. Organ-on-a-chip: Engineered Microenvironments for Safety and Efficacy Testing. (ISBN: 978-0128172025)
Assessment methods	Written exam + optional interview

Further information

Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile