UCL Université catholique de Louvain

LBIR1310

2013-2014

Transfer phenomena

4.0 credits	45.0 h + 15.0 h	1q

Teacher(s) :	Javaux Mathieu (coordinator) ; Vanclooster Marnik ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	iCampus
Prerequisites :	LBIR1200 Math 2 LBIR1210 General Physics 2
Main themes :	Biosciences and engineering implies an in depth understanding of fluid dynamics and transfer of heat and mass transfer in complex systems such as agricultural soils, living organisms, plants, natural environmental systems, bioreactors, chemical reactor chains, etc. The course covers the basic principles of fluid mechanics and thermodynamics. After introducing the physical and thermodynamic theory, operational equations are presented to solve simple problems in fluid mechanics and mass transfer and energy. These equations support the design of many devices operated by bio-scientists and bio-engineers such as hydraulic circuits, machines, hydraulic and pressure measurement systems, pumps, heat exchangers, air conditioning systems, '
Aims :	a. Learning outcomes 2.1 ; 2.3 ; 4.1 ; 4.2 ; 4.3 ; 4.4 ; 6.4 ; 6.5 b. Specific formulation of learning outcomes At the end of the course and practical work, students will be able to: · Understand the laws of conservation of mass, momentum and energy based on principles of fluid mechanics and thermodynamics; · Develop mathematical formulations to describe the transfer of mass and energy in specific environments for the bio-engineer, under transient and steady states and for simple operational conditions (boundary conditions); · Calculate mass transfer and energy for simple problems specific to the domain of the bio-engineer; · Describe the principles of certain technologies associated with heat or momentum or mass transfer as for instance, pumps, heat exchangers, air-conditioning systems; · Describe the principle of measurement techniques like i.e. the measurement of flow and pressure in hydraulic circuit, the measurement of moist air variables; · Address various applications of mass transfer and energy, with a basic modeling knowledge of phenomena like conduction, convection, radiation, turbulence, diffusion, evaporation, etc.. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Oral examination with written preparation for the theory. Written examination on exercises
Teaching methods :	Class room lectures and supervised calculation exercises
Content :	- Fluid mechanics: · Conservation of mass · Conservation of momentum · Equation of mechanical energy · Conservation of energy · Navier-Stokes equation · Laminar and turbulent Flow · Dimensional analysis and similarity · Head loss in closed conduits · Concept of boundary layer, turbulence, friction coefficients · Hydraulic Pumps Heat transfer: · Heat transfer by conduction: plane wall, cylindrical wall, electric cable, chemical reaction, transient conduction · Heat transfer by convection: forced convection and natural convection, convection coefficients, heat exchangers Mass transfer by radiation Applied Thermodynamics: Humid air, principles of air conditioning
Bibliography :	- Giot, M. (2000). Phénomènes de transfert - Fluide, chaleur, masse. 3ème édition. CIACO, UCL.(compulsory) - Copie of the powerpoint presentation used during the class room lecture - Copie of the calculation exercises

Cycle and year of study :	> Bachelor in Bioengineering
Faculty or entity in charge:	AGRO