Course Specifications

Valid as from the academic year 2020-2021

Modelling of Physiological Systems (E092621)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)

Credits	Study time	Contact hrs
6.0	180 h	67.5 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 2)	English	Gent	lecture	30.0 h
			practicum	5.0 h
			seminar: practical PC room classes	18.75 h

Lecturers in academic year 2020-2021

Glorieux, Griet	GE35	staff member
JACQUES, PEGGY	GE35	staff member
Segers, Patrick	TW06	lecturer-in-charge
Debbaut, Charlotte	TW06	co-lecturer
D'Herde, Katharina	GE38	co-lecturer
Eloot, Sunny	GE35	co-lecturer
Verhulst, Sarah	TW05	co-lecturer

Offered in the following programmes in 2020-2021	crdts	offering
Bachelor of Science in Engineering (main subject Biomedical Engineering)	6	A
Brugprogramma Master of Science in Bioinformatics (main subject Engineering)	6	A
Master of Science in Electrical Engineering (main subject Communication and Information Technology)	6	A
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	6	A
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	A
Master of Science in Bioinformatics (main subject Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	A
Master of Science in Chemical Engineering	6	A
Master of Science in Civil Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Computer Science Engineering	6	A
European Master of Science in Photonics	6	A
Master of Science in Sustainable Materials Engineering	6	A
Master of Science in Chemical Engineering	6	A
Preparatory Course Master of Science in Biomedical Engineering	6	A

Teaching languages

English

Keywords

physiology, organ systems, electrophysiology, hemodynamics, experimental and

mathematical model

Position of the course

The aim of the course is to familiarize the student with human physiology in general and physiological systems in particular, with attention to biological control and regulation mechanisms. The organism is studied on cellular and organ level, as well as on an integrated level. There is attention for transport physics and modelling techniques applied to physiological systems.

Contents

- Introduction: The human body on a macroscopic scale
- Homeostasis: Homeostasis in the body and glucose homeostasis
- The nervous system: Sympathetic and parasympathetic nervous system,
- Communication between (nerve)cells, Hodgkin-Huxley model
- Physiology of muscle cells: Anatomy and physiology, Force-Length-Frequency relation
- Arterial system physiology: Anatomy and physiology, Models of the arterial system: windkessel and wave system
- Cardiac physiology: The heart as a pump
- The cardiovascular system: Heart-arterial coupling, Computer exercise on the cardiovascular system
- The kidney: Anatomy and physiology of the kidney, Kinetic modelling
- The lungs and respiration: Anatomy and physiology of the lung
- Digestion, metabolism and temperature control: Basic and physiological aspects
- The brain: Anatomy and physiology
- Laboratory visits and practical sessions

Initial competences

no specific prior knowledge required

Final competences

1 KNOWLEDGE OF: basic knowledge of physiology; action potentials, ion channels; force-length-frequency relation; pressure-volume relations, contractility, preload and afterload; pressure-diameter relation, visco-elasticity, impedance; lumped parameter models; arterial pressure wave reflection; heart-arterial coupling; kinetic modelling, osmolarity, convection, diffusion; perfusion, gas transport, disscociation curves; wave intensity analysis.
2 ACQUIRED INSIGHTS: propagation of electrical signals and communication between cells; function of individual muscle cells, experimental models; anatomy and function of the heart; assessment of the heart as a pump; mechanical behaviour of blood vessels and quantification of mechanical properties; generation of arterial blood pressure and flow and contribution of the heart and the arteries herein; anatomy and function of the kidney, control mechanisms; (modelling of) mechanics of and gas exchange in the lung; Insight in the anatomy of the brain
3 Analysis and schematizing of physiological processes
4 Practical knowledge on the analysis of hemodynamic data (arterial pressure and flow, ventricular pressure and volume) and quantification of systolic function, system analysis of the arterial system, quantification of the interaction between the heart and the arterial system (via spreadsheet and Matlab applications)

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Demonstration, lecture, practicum, seminar: practical PC room classes

Extra information on the teaching methods

PC exercises can be done on the student's own laptop. Depending on the covid-19 health situation, classes can take place in a hybrid way with on-campus teaching for a small group and live streaming, or entirely online.

Learning materials and price

syllabus and handouts of powerpoint presentations made available to the students via the electronic learning environment

References

"Anatomy & Physiology", Elaine Marieb & Katja Hoehn, Pearson International Edition,

ISBN-13: 987-0-321-48816-9

Course content-related study coaching

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, written examination with multiple choice questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, written examination with multiple choice questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

During examination period: written closed-book exam with open questions, multiple-choice questions and exercises and applications.

Calculation of the examination mark