COURSE UNIT DESCRIPTION

Course unit title	Code
Innovative Technologies in Motion Control	

Annotation
The course focuses on the trends and the latest achievements in motion control technologies and its application in the practise and research of rehabilitation.

Lecturer(s)	Department, Faculty
Coordinating: Aurelija Šidlauskienė, PhD, assoc. professor **Other:** prof. J. Griškevičius, prof. R. Dadelienė, assistant J. Blaževičius, assistant T. Aukštikalnis, lector G. Juškėnienė	Faculty of Medicine, Department of Rehabilitation, Physical and Sports Medicine Santariškių str. 2, Vilnius, LT–08661

Study cycle	Type of the course unit
Second	Mandatory

Mode of delivery	Semester or period when it is delivered	Language of instruction
Auditorium	III semester	Lithuanian, English

Requisites	
Prerequisites: -	**Co-requisites (if relevant):** -

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
5	118	46	72

Purpose of the course unit: programme competences to be developed

The aim of the course is to provide knowledge for students about the trends and the latest achievements in motion control technologies; to develop the abilities critically evaluate researches in this field and on the basis of it to choose the adequate rehabilitation methods and to analyze it's effectiveness in accordance with the provisions of professional ethics.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
A1 Students demonstrate knowledge about innovative motion control technologies, its application possibilities and limitations in practice. Studens apply knowledge about the peculiarities of mastering innovative technologies and methodologies in rehabilitation.	Presentation of the problem during the lecture. Individual presentation of the task during the seminar.	Exam (see criteria below).
B3 Students are able to analyze a scientific information independently; to evaluate results of researches, to monitor its dynamics and use it for scientific purposes.	Problem-based learning in groups (analysis of situations, identification and solution of problem)	Formative assessment of problem analysis and solution in order to test the application of the theory in practice,

C2,C3 Students are able to apply rehabilitation scientific issues and insights in the development and mastery of innovative rehabilitation equipment, and are able to work individually with robotic equipment. Students are able to apply information technologies in their clinical practice to initiate researches and analyse its results.	Case analysis, presentation, discussion. Case modeling, presentation, discussion. Exercises with the provided equipment.	depending on the patient's functional status. Formative assessment of case analysis and modeling during seminars. Presentation of the group activities (see criteria below).
D1,D2 Students are able to convey the scientific information in argumentative, clear and precise manner. Students are able to communicate and collaborate with rehabilitation and other professionals as well as patients.	Preparation of the presentation of the group's activities.	Exam (see criteria below).
E1, E2 Students are able to evaluate critically innovative technologies and methodologies applied by themselves and by other professionals. Students are able to initiate independently decision-making, selection and application of methods for analyzing effectiveness, in accordance with the provisions of professional ethics.		

Course content: breakdown of the topics	**Contact hours**								**Individual work: time and assignments**
	Lectures	Tutorials	Seminars	Workshops	Laboratory work	Internship/work	**Contact hours, total**	**Individual work**	**Assignments**
1. Compensation of movement disorders and training in rehabilitation: achievements and insights of innovative technologies.			2				**2**	**10**	Analysis of scientific literature and report of scientific achievements in innovative technologies development and implementation in rehabilitation.
2. Research of human movements and computer modeling for innovative technologies validation.	2		2				**4**	**6**	
3. Neuroprosthetics: Prostheses controlled by the neuromuscular control system; bionic arm / leg.			4				**4**	**12**	Report of scientific literature on the latest robotics technologies in rehabilitation and its safety requirements, implementation, application, efficiency of results. Analysis of the principles of modern neurorabilitation in different pathologies: after stroke, spinal cord injury, polytrauma, etc. Workshops: evaluation of rehabilitation efficiency using isokinetic dynamometer.
4. Application of robotics achievements in rehabilitation; modern motion rehabilitation robots (MIT-Manus, ARM GUIDE, ARMin, MIME, GENTILE/s, Pneu-WREX, RUPERT, REHORB, Lolo). Smart homes. Robots in the home environment. Robotic wheelchair control system and additional tools (smart wheels, electric motors, eye gaze / tongue control).	2		6				**8**	**12**	
5. Virtual reality technologies and its application in rehabilitation (Xbox Kinect, Optitrac, 3D system), Tele-rehabilitation.	2		3				**5**	**8**	
6. Special systems for testing and investigating rehabilitation efficiency: in neuromuscular	4		9	10			**23**	**24**	

disorders (gait, balance, coordination, functional movement disorders) and cognitive impairment.									
Total	**10**		**26**	**10**			**46**	**72**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Presentation of group‘s activities (PowerPoint presentation) (X)	40	During the semester	Evaluation criteria and maximum scores for the presentation of the group's activities: • ability to analyze appropriate scientific and informational literature, various documents (3 points); • understanding and revealing the topic (3 points); • ability to express thoughts clearly and consistently, to summarize and substantiate conclusions (2 points); • presentation of material by multimedia means (1 point); • written language culture, literature sources are correctly cited (1 point);
Exam (Y)	60	Session	Test consists of 25 questions: one answer is correct for each question. Evaluated on a 10-point scale: each question is evaluated with 0.4 points. The exam is allowed to be taken if the student has completed all the tasks provided in the description of the course during the semester.
Final evaluation (A)		Session	A = aX + bY; X – Presentation of group‘s activities; Y – Exam; a , b – weight (0,4; 0,6). The final evaluation is calculated according to the formula which is averaged to an integer according to mathematical rules.

Author	Publishing year	Title	Issue of a periodical or volume of a publication; pages	Publishing house or internet site
Required reading				
Thomas K. Uchida, Scott L Delp, David Delp.	2021	Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation	1st edition	The MIT Press
Joseph Hamill; Kathleen Knutzen; Timothy R Derrick.	2022	Biomechanical basis of human movement.	5th edition	Lippincott Williams and Wilkins
Latash M., Zatsiorsky V.	2016	Biomechanics and motor control: defining central concepts	1st edition	Academic Press
Laczko J., Latash M.	2016	Progress in Motor Control: Theories and Translations	3rd edition	Springer
Encarnacao P. et al	2017	Robotic Assistive Technologies: Principles and Practice	1st edition	CRC Press
Xie Shane	2016	Advanced Robotics for Medical Rehabilitation: Current State of the	1st edition	Springer

		Art and Recent Advances		
Recommended reading				
Journal of NeuroEngineering and Rehabilitation: https://jneuroengrehab.biomedcentral.com/				
Web of Science: www.sciencedirect.com				
PubMED: www.ncbi.nlm.nih.gov/pubmed				
Siegert, R.J., William, M.M.	2015	Rehabilitation goal setting: theory, practice, and evidence.		CRC Press/Taylor & Francis Group. (Rehabilitation science in practice series)
Umphred DA, Lazaro RT, Roller ML, Burton GU	2013	Neurological rehabilitation	Sixth edition	Elsvier, USA
Shumway-Cook A, Woollacott M.	2012	Motor Control: Translating Research Into Clinical Practice	Fourth edition	Lippincott Williams & Wilkins