

Subject card

Subject name and code	Transdermal Delivery Systems, PG_00209962						
Field of study	Medical Physics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Optional subject group Subject group related to scientific research in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		3.0		
Learning profile	academic		Assessment form		credit		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Paweł Rochowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	45		0.0		30.0	75
Subject objectives	The course is designed to introduce students to the principles of transdermal transport of substances, with particular emphasis on: 1. the characterization of passive and active transdermal delivery systems; 2. experimental methods employed in transdermal transport studies; 3. the modeling of transdermal transport processes and the determination of the critical parameters governing their performance.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZMEDMU2_W04] Knows and understands in depth the theoretical foundations and principles of operation of measurement systems and research, diagnostic and therapeutic equipment specific to the field of physics and medicine.	The student has an advanced knowledge and understanding of the operating principles of measurement and research instrumentation used in the analysis of therapeutic transdermal systems and transdermal transport processes.	[SW4] test/exam - oral or written
	[FIZMEDMU2_W01] Knows and understands in depth selected issues in the field of physics and medicine, the complex relationships between them, and development trends in the exact and natural sciences, health sciences, and others.	The student has an advanced knowledge and understanding of selected topics related to therapeutic transdermal systems, their relationships with physical processes and medical applications, as well as current trends in the development of this field.	[SW4] test/exam - oral or written
	[FIZMEDMU2_U06] Can effectively communicate on specialised topics in the field of physics and medical physics with diverse audiences (specialists and non-specialists), skillfully justifying his/her position.	The student is able to present and discuss issues related to therapeutic transdermal systems, using appropriate terminology and argumentation based on scientific knowledge, while taking into account audiences with varying levels of expertise.	[SU2] presentation/project/paper/report
	[FIZMEDMU2_U03] Can find necessary information in professional literature, both in databases and other sources.	The student is able to obtain and analyze information on therapeutic transdermal systems from scientific literature, databases, and other scholarly sources.	[SU2] presentation/project/paper/report
Subject contents	Transport Processes in Porous Materials - Driving forces and fluxes. - Passive transport – diffusion in binary systems: Fick's laws, temperature dependence of the diffusion coefficient; diffusion in multicomponent systems: the Maxwell–Stefan model; transport phenomena in the context of the principles of thermodynamics. - Active transport – advection: the Nernst–Planck equation, Darcy's law, and the Navier–Stokes equation. - Porous media – methods for averaging characteristic properties; sorption and mechanical dispersion processes; the general model of mass transport in porous media. - Chemical potential and concentration; surface excess and interfacial interactions. Transdermal Transport - Structure and functions of the skin; analogies between the skin and other porous materials. - Common models of passive drug permeation (basic diffusion-based models: Higuchi, Korsmeyer–Peppas, Weibull, etc.; models for complex systems: compartmental modeling and RC models). - Physical methods for enhancing transdermal transport: iontophoresis, sonophoresis, electroporation, and penetration enhancers. - Overview of experimental methods in transdermal drug delivery system (TDS) research: characterization of the structure and barrier function of the stratum corneum using microscopy, UV/Vis and IR spectroscopic techniques, NMR, photothermal techniques, and photoacoustic spectroscopy and profilometry.		
Prerequisites and co-requisites	Completed undergraduate-level (Bachelor's degree) courses in Mechanics and Thermodynamics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	multimedia presentation	51.0%	50.0%
	test	51.0%	50.0%
Recommended reading	Basic literature	1. Transport Phenomena 2nd ed., R.B. Bird, W.E. Stewart, E.N. Lightfoot, Wiley&Sons, 2002. 2. Fundamentals of Heat and Mass Transfer 6ed, F.P. Incropera, D.P. Dewitt, T.L. Bergman, A.S. Lavine, Wiley&Sons, 2007. 3. Mechanisms of Transdermal Drug Delivery, R.O. Poots, R.H. Guy (edtrs), Marcel Dekker, 1997. 4. Transdermal Drug Delivery, Concepts and Applications 1st ed, K. Ita, Academic Press, 2020	
	Supplementary literature	-	
	eResources addresses		

Example issues/ example questions/ tasks being completed	• Describe the concept of drug release profiles. • Describe the experimental techniques used to determine drug release kinetics. • Describe predictive models of drug transport. • Describe the mechanisms of drug transport.
Work placement	Not applicable

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