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NAWA Narodowa Agencja Wymiany Akademickiej

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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

Summer School
PROBLEMS OF ELDERLY PATIENTS AS AN INTERDISCIPLINARY ISSUE

Organised by

PUT

b-tu Brandenburg University of Technology Cottbus - Senftenberg | UC Universidad de Cantabria | Università di Catania | Université Polytechnique Hauts-de-France | UMONS University of Mons | University of the Peloponnese | Vaasan yliopisto University of Vaasa | Politécnico de Viseu

1. IDENTIFYING DATA.	
· Course Name.	Problems of elderly patients as an interdisciplinary issue [Indicate the course name in the language of instruction and its local code if available / needed]
· Coordinating University.	Poznan University of Technology (PUT) [Indicate the name of the university that coordinates the course]
· Partner Universities Involved.	[Indicate the name of the partner universities participating in the course, if any]
· Course Field(s).	Interdisciplinary programmes and qualifications involving: Biomedical Engineering, Mechanical Engineering, Architecture, Safety Engineering. [Indicate the field of the course]
· Related Study Programme.	N/A [Indicate which study program the course is part of, if any]
· ISCED Code.	0788 [Indicate the International Standard Classification of Education that is used internationally as a reference for organising education programs and related qualifications by levels and fields]
· SDG.	https://sdgs.un.org/goals : 3, 4 [List the most important Sustainable Development Goals (SDG) that the course relates to (list available here)]
· Study Level.	The summer school is open to students in Bachelor's (B), Master's (M), and Doctorate (D) study programs. [Indicate if the course is part of a Bachelor (B), Master (M) or Doctorate (D) study program and what study levels it is open for]

· Number of ECTS credits allocated.	2 ECTS [Indicate the number of ECTS credits allocated to the course]
· Mode of Delivery.	The full Summer School program on-site Lectures – on-site at PUT Exercises – on-site at PUT Workshops – on-site at PUT [Indicate if the course is delivered "Online live", "Online self-study", or "onsite"]

· Language of Instruction.	English [Indicate in which language(s) the component is taught. If the component is taught in the domestic language, but may include guest lectures given by international guest lecturers or group work with international groups of students, it is relevant to mention that the language of instruction can also be English]
· Course Dates.	The summer school will take place from 7 to 11 September 2026. The course will begin on 7 September 2026. The course will end on 11 September 2026. [Indicate starting and end dates of the course]
· Precise Schedule of the Lectures*.	Duration: 15 lectures hours (15x45 min.) **Day 1 – Classes on 7 September (Monday):** Welcome/Introduction – 9:00-9:30 Lecture no. 1 – 9:30-11:00 Lecture no. 2 – 11:30-13:00 **Day 2 – Classes on 8 September (Tuesday):** Lecture no. 3 – 9:30-11:00 Lecture no. 4 – 11:30-13:00 **Day 3 – Classes on 9 September (Wednesday):** Lecture no. 5 – 9:30-11:00 Excursion – 11:30-13:30 **Day 4 – Classes on 10 September (Thursday):** Lecture no. 6 – 9:30-11:00 Lecture no. 7 – 11:30-13:00 **Day 5 – Classes on 11 September (Friday):** Lecture no. 8 – 9:30-11:00 Final Test/Closing – 11:30-13:00 *The final timetable is subject to minor changes, and the final version with rooms numbers will be provided to participants before the Summer School begins. [Indicate duration and periodicity of the course lectures and other synchronously delivered course activities]

· Key Words.	Healthy Ageing, Age-Friendly Design, Universal Design, Human Factors and Ergonomics, Digital Human Modelling, Ergonomic Simulation, Movement Biomechanics, Motion Analysis, Artificial Intelligence in Healthcare, Biomedical Engineering [Indicate key words of the course]
· Catchy Phrase.	Discover how inclusive design, engineering and AI can empower healthy and independent ageing [Include an engaging phrase or slogan to be used in the course flyers, if possible in the format of a "testimonial" and around 15 words]

· Prerequisites and co-requisites.	Minimum B2 in English CEFR level; general knowledge about human body, aging. Students of PUT, EUNICE and Medical University of Bialystok; Science and engineering students (B, M, D). [Provide information on: - whether a student must have successfully completed certain courses before s/he can take this course and any other requisites such as i.e. linguistic skills; - The study levels this course is available for (B, M or D); - Required linguistic skills]
· Number of EUNICE students that can attend the Course.	Total: 15 students 9 students from EUNICE (1 UMONS, 1 UNICT, 1 BTU, 1 UVA, 1 KU, 1 UPHF, 1 UoP, 1 UC, 1IPV) 6 students from UMB [Indicate the maximum number of EUNICE students/staff members that can attend the course (total number + reserved spots per partner university)]
· Course inscription procedure(s).	Standard EUNICE procedure [Indicate the registration procedures if it differs from the standard EUNICE process]

2. CONTACT DETAILS.	
· Department.	Faculty of Mechanical Engineering Poznan University of Technology, Institute of Applied Mechanics, Division of Virtual Engineering [Indicate the department to which the course is linked]

· Name of Lecturer.	Michał Rychlik, DSc. Ph.D. Eng., prof. PUT [Indicate the name of the lecturer(s) delivering the course]
· E-mail.	michal.rychlik@put.poznan.pl [Indicate the contact details of the person in charge of the course]
· Other Lecturers.	Agata Bonenberg, Prof. DSc. PhD Eng. Arch., Full Professor, (PUT) Poznan University of Technology, Institute of Interior Design and Industrial Design, Faculty of Architecture agata.bonenberg@put.poznan.pl Marcin Butlewski, DSc. Ph.D. Eng., prof. PUT, (PUT) Poznan University of Technology, Institute of Safety and Quality Engineering, Faculty of Engineering Management, Division of Applied Ergonomics marcin.butlewski@put.poznan.pl Maciej Sydor, Prof. DSc, PhD, Eng., Full Professor, (PUT) Poznan University of Technology, Institute of Safety and Quality Engineering, Faculty of Engineering Management, Division of Applied Ergonomics maciej.sydor@put.poznan.pl Jakub Grabski, Ph.D. Eng. Assistant Professor (PUT) Poznan University of Technology, Institute of Applied Mechanics, Division of Technical Mechanics jakub.grabski@put.poznan.pl Martyna Białecka, Ph.D. Eng. Assistant Professor (PUT) Poznan University of Technology, Institute of Applied Mechanics, Division of Technical Mechanics martyna.bialecka@put.poznan.pl Martyna Sopa, Ph.D. Eng. Assistant Professor (PUT) Poznan University of Technology, Institute of Applied Mechanics, Division of Technical Mechanics martyna.sopa@put.poznan.pl [Indicate the names of other people who take part in lectures]

3. COURSE CONTENT.

The summer school runs for 5 days (a total of 15 hours of classes) and consists of five Modules include lectures, exercises and workshops, which will take place in person at Poznan University of Technology (Poznan, Poland).

Module 1 – Design for Healthy Ageing

UNIVERSAL DESIGN – INCLUSIVE SPACE: Building as a Primary Means of Preventative Care. This course module combines a theoretical lecture with a practical game-based workshop to explore how the built environment can support health, well-being, and social inclusion throughout the human lifespan. Participants will learn the principles of Universal Design, focusing on creating accessible, safe, and comfortable spaces for people of all ages and abilities. Special attention is given to the needs of older adults, mobility support, cognitive accessibility, fall prevention, social interaction, and healthy aging. The lecture introduces key concepts, case studies, and evidence-based design strategies that demonstrate how buildings and public spaces can act as a form of preventative care by reducing health risks and promoting independence. During the interactive workshop, participants engage in a game-based design exercise. Through collaborative problem-solving, they will develop inclusive spatial solutions for better accessibility, autonomy, and quality of life for all users.

Module 2: Human Factors and Inclusive Design

Part 1. The course focuses on human error in the context of designing products, services and work systems for ageing societies. Students are introduced to the role of ergonomics and human factors in understanding why people make mistakes, especially when cognitive, sensory or physical capabilities change with age.

The course covers selected causes of human error, including workload, stress, fatigue, reduced attention, perception limitations, communication problems and poor system design. Human error is discussed not as an individual failure, but as a result of interaction between users, tasks, technology and organizational conditions.

Practical classes introduce basic methods for identifying and reducing errors, especially Hierarchical Task Analysis — HTA — and SHERPA. Students learn how to analyse tasks, identify possible errors and propose design improvements supporting safety, usability and independence of older users.

Part 2. This lecture explores the dialectic between Universal Design and reasonable accommodation as „a meter" of inclusivity. Listeners will analyze Universal Design as a proactive, ex ante strategy aimed at creating inherently accessible environments, products, and digital spaces without subsequent modifications, as exemplified by modern global infrastructure. Conversely, reasonable accommodation is examined as a reactive, ex post corrective mechanism applied to legacy systems or historical structures, defined by individualization, functional necessity, and the principle of proportionality. Special emphasis is placed on the critical evaluation of alternative access—such as separate entryways or dedicated document versions—highlighting how it compromises the user experience and perpetuates segregation and stigmatization. Using a medical analogy, the course frames Universal Design as systemic prevention and accommodation as symptomatic treatment, establishing a framework where the ultimate goal is inherent, barrier-free accessibility.

Module 3: Digital Human Modelling for Healthy Ageing

Introduction to digital human modelling and its role in the design and evaluation of products, environments and assistive technologies for older adults. Overview of age-related changes affecting human mobility, posture, joint range of motion, strength and functional capabilities. Presentation of digital human modelling tools available in CATIA Human Builder/Human Activity Analysis and Blender Armature environments.

Practical exercises include the creation and modification of digital human models representing elderly users, adjustment of anthropometric and biomechanical parameters, and simulation of typical daily-life activities. Participants will perform ergonomic analyses of selected tasks and interactions with equipment and living environments. The course also introduces the use of computer simulations to identify accessibility barriers and improve safety, comfort and usability for ageing populations.

Module 4: Movement Biomechanics and Motion Analysis

During this module, students will gain an understanding of the fundamental principles of human movement biomechanics and motion analysis. They will learn about the latest technologies used for motion analysis and how they translate into practical applications in sport, rehabilitation and ergonomics. They will discover how human motion laboratory experiments are conducted, from measurement to data analysis.

This part of the summer school concentrates on the skills necessary for:

- Understanding basics of Biomechanics of human body;
- Learning about biomechanical description of basic human movements, e.g., gait;
- Understanding how human motion-capture systems operate, the different types that exist, and the strengths and limitations of each.

Module 5: AI-Assisted Medical Diagnostics

During the lecture on AI assisted diagnostics, basics of different artificial intelligence methods will be presented and analyzed, including artificial neural networks. The lecture will be focused on the application of these techniques for diagnostics based on medical images. In particular, the presented case studies will focus on the diagnosis of Alzheimer's disease.

[Provide a brief description of the content of the course. This information bears a close link to the learning outcomes of the component, but has a different function. It will be used for communication purposes to describe the course whereas the learning outcomes serve academic purposes. If available, a link to the local course guide can be added]

4. LEARNING OUTCOMES.

By the end of the Summer School, participants will be able to:

Module 1 – Design for Healthy Ageing

Upon successful completion of the course module, participants will be able to:

- Explain the principles of Universal Design and their role in creating inclusive, accessible, and health-supportive environments.
- Recognize the relationship between the built environment and preventative healthcare, understanding how buildings and public spaces can promote physical, mental, and social well-being.
- Identify the needs of diverse user groups, with particular emphasis on older adults, including mobility, sensory, cognitive, and social requirements.
- Develop inclusive design solutions
- Integrate Universal Design principles into architectural, urban, and interior design proposals to improve quality of life for all users.
- Communicate design concepts effectively and justify design decisions based on inclusivity, accessibility, and health-promoting criteria.
- Work collaboratively in interdisciplinary teams to address real-world challenges related to aging societies and inclusive environments.

Module 2: Human Factors and Inclusive Design

Part 1. After completing this part of the course, the student is able to:

- explain the concept of human error from the human factors and ergonomics perspective;
- identify age-related factors that may increase the risk of errors;
- distinguish between user blame and system-based analysis of error;
- classify basic types of human error, such as omission, commission, sequence and timing errors;
- apply basic task analysis to identify potential errors in products, services or work systems;
- propose human-centred design improvements reducing error risk among older users.

Part 2.

- Differentiate between the proactive paradigm of Universal Design (ex ante) and the reactive mechanism of reasonable accommodation (ex post), accurately identifying their distinct roles within safety engineering and socio-technical systems.
- Evaluate existing architectural, digital, and organizational infrastructures to identify systemic barriers, applying the principles of functional necessity and proportionality to determine where universal solutions have failed or require correction.
- Critique the implementation of alternative access methods, assessing their potential to cause user stigmatization, functional degradation, or socio-spatial segregation.
- Formulate engineering and design strategies that integrate inherent, barrier-free accessibility into the early stages of product, service, or spatial development, minimizing the need for subsequent individual adaptations.
- Apply the prevention-versus-treatment analogy to organizational policies, shifting project management strategies from temporary, symptomatic adjustments to long-term, systemic inclusion frameworks.

Module 3 – Digital Human Modelling for Healthy Ageing

Knowledge

- Explain the role of digital human models in ergonomics, healthcare engineering and age-friendly design.
- Describe selected physiological and biomechanical changes associated with ageing that influence human-device and human-environment interactions.
- Identify basic methods and software tools used for ergonomic assessment and virtual simulation of elderly users.

Skills

- Create and modify a digital human model representing an older adult.
- Perform basic ergonomic simulations and posture analyses using digital human modelling software.
- Interpret simulation results and identify potential ergonomic risks, accessibility limitations and design improvements for elderly users.

Social Competences

- Recognise the importance of interdisciplinary collaboration in addressing challenges related to ageing societies.
- Critically evaluate technological solutions intended to improve the quality of life, safety and independence of older adults.

Module 4: Movement Biomechanics and Motion Analysis

Knowledge

- Explain the basic principles of human movement biomechanics.
- Describe the biomechanical characteristics of gait and other selected motor activities.
- Identify different motion capture technologies and their applications.

Skills

- Operate selected motion analysis systems and dynamometric platforms.
- Interpret basic biomechanical parameters obtained during gait analysis.
- Compare marker-based and markerless motion capture approaches.

Social Competences

- Recognise the value of interdisciplinary collaboration between engineering, medicine and rehabilitation sciences.

Module 5: AI-Assisted Medical Diagnostics

1. Explain the basic principles of artificial intelligence and machine learning in healthcare.
2. Describe selected applications of AI in medical image analysis.
3. Discuss the role of AI in supporting the diagnosis of Alzheimer's disease.
4. Critically assess the benefits and limitations of AI-assisted diagnostics.

[Provide a list of the expected learning outcomes for this course, including skills and competencies acquisition and knowledge acquired in the course]

5. OBJECTIVES.

Module 1 – Design for Healthy Ageing

The course aims to:

- Provide participants with a comprehensive understanding of the principles of Universal Design and their application in creating inclusive, accessible, and health-supportive environments.
- Explore the relationship between the built environment and preventative healthcare, highlighting how architectural and urban design can contribute to physical, mental, and social well-being.
- Increase awareness of the diverse needs of users, particularly older adults, including mobility, sensory, cognitive, and social requirements.
- Develop participants’ ability to create inclusive design solutions that promote accessibility, independence, safety, and quality of life.
- Equip participants with practical tools for integrating Universal Design principles into architectural, urban, and interior design projects.

- Strengthen skills in communicating and evaluating design proposals using inclusivity, accessibility, and health-promotion criteria.
- Foster interdisciplinary collaboration and problem-solving skills necessary for addressing the challenges of aging populations and creating age-friendly environments.
- Encourage critical and user-centered thinking through the analysis and development of spaces that support lifelong well-being and social inclusion.

Module 2: Human Factors and Inclusive Design

The objective of the course is to develop students' ability to analyse and reduce human error in design for ageing societies.

The Part 1. course aims to:

- show how ageing-related changes in perception, attention, memory and physical abilities influence error risk;
- present human error as a systemic design problem rather than only an individual mistake;
- introduce ergonomic and human factors principles useful in designing for older adults;
- develop practical skills in using HTA and SHERPA for error prediction;
- support the design of safer, more accessible and more human-centred solutions for ageing users.

The Part 2. course aims to:

- Introduce the contrasting theoretical frameworks of Universal Design (ex ante) and reasonable accommodation (ex post), highlighting the paradigm shift from reactive compliance to proactive inclusivity.
- Analyze the legal, technical, and ethical criteria that govern individual accessibility interventions, specifically focusing on functional necessity and the boundaries of the principle of proportionality.
- Critically examine the socio-technical and psychological impacts of alternative access mechanisms, exploring how separate functional pathways can lead to user segregation and stigmatization.
- Provide students with actionable methodologies and global case studies for embedding inherent, barrier-free accessibility into the preliminary stages of architectural, engineering, and digital workflows.

- Cultivate a strategic management mindset that applies the medical analogy of prevention versus treatment, guiding organizational policies from temporary, symptomatic adjustments toward long-term systemic inclusion.

Module 3 – Digital Human Modelling for Healthy Ageing

The main objective of the course is to introduce participants to the use of digital human modelling and ergonomic simulation techniques for analysing the needs and limitations of older adults. The course aims to demonstrate how virtual human models can support the design, evaluation and optimisation of medical devices, rehabilitation solutions, assistive technologies and living environments dedicated to ageing populations. Through practical exercises, participants will gain hands-on experience in creating digital human models and performing ergonomic analyses that support evidence-based design for healthy and active ageing.

Module 4: Movement Biomechanics and Motion Analysis

The module aims to:

- introduce participants to the principles of human movement biomechanics;
- demonstrate modern methods of motion analysis and gait assessment;
- provide hands-on experience with motion capture systems and dynamometric platforms;
- develop participants' ability to interpret biomechanical measurement results.

Social competences:

1. **Lifelong learning:** Recognizing the importance of continuous professional development and fostering a similar approach in others.
2. **Interdisciplinary awareness:** Recognizing the societal benefits of integrating engineering and biomedical knowledge.
3. **Effective communication:** Understanding the importance of clearly communicating technological and medical advancements to the public.

Module 5: AI-Assisted Medical Diagnostics

The main objective of the lecture is to explain to students the fundamentals of AI techniques and demonstrate their role in modern medical diagnostics. It will be shown based on the Alzheimer's disease as a case study.. The lecture will review different AI techniques, which can be used for analyses of medical images for diagnostic purpose.

[Provide a list of the main objectives that are aimed to be achieved during the course of these studies]

6. COURSE ORGANISATION.

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UNITS	
	Day 1 – Welcome, Module 1: Design for Healthy Ageing
1.	Welcome, Introduction to Summer School (M. Rychlik)
2.	Lesson 1 –Built environment as primary means of preventative care – lecture (A. Bonenberg)
3.	Lesson 2 – Built environment as primary means of preventative care – workshop (A. Bonenberg)
	Day 2 – Module 2: Human Factors and Inclusive Design
1.	Lesson 3 – Human error in design for ageing societies (M. Butlewski)
2.	Lesson 4 – Rational Adaptation in the Universal Design – lecture (M. Sydor)
	Day 3 – Module 3: Digital Human Modelling for Healthy Ageing
1.	Lesson 5 – 3D modelling and ergonomic simulations for older people using digital human models – Lecture/exercise (M.Rychlik)
2.	Excursion – The History of Poland and Poznań – Genius Loci Archaeological Reserve (M. Rychlik)
	Day 4 – Module 4: Movement Biomechanics and Motion Analysis
1.	Lesson 6 – Biomechanical description of human movement, Motion Capture systems and analysis of human gait – lecture (J. Grabski)
2.	Lesson 7 – Biomechanical analysis of human gait using the motion analysis marker based vs markerless system and dynamometric platforms for various motor activities – exercise (M. Białecka, M. Sopa)
	Day 5 – Module 5: AI-Assisted Medical Diagnostics/ Closing Summer
1.	Lesson 8 – AI in supporting the diagnosis of elderly patients: the case of Alzheimer's disease (J. Grabski)

2.	Final test / Summary and closing of the Summer School (M. Rychlik)

LEARNING RESOURCES AND TOOLS.
Multimedia presentation, educational media, virtual classroom activities. Lectures/Exercises/Workshops (on-site): conducting experiments, problem solving, discussion, work in group. [List the most important learning resources and tools]
PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.
Lectures: on-site multimedia presentation illustrated with examples related to the topic under discussion. Exercises/workshops: on-site group work of the functioning of measuring equipment (motion capture systems), experimental exercises, body motion measurements, data analysis, writing experiment reports, discussion (all elements performed in work groups). [List the most important learning activities for this course, e.g. lectures, group work, seminars, tutorials, etc.]

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.

The knowledge acquired during the course is verified by following components:

1) Test on topics covered in class –passing threshold of 50%.
2) Completion of planned exercises/workshop and related tasks,– passing threshold of 50%.
3) Attendance at minimum 80% of classes.

The overall grade is the mean of the scores obtained in test and exercises/workshop tasks.

Grades:
91% – 100% - 5.0 (very good)
81% – 90% - (good plus)
71% – 80% - 4.0 (good)
61% – 70% - 3.5 (pass with distinction)
50% – 60% - 3.0 (pass)

below 50% - 2.0 (fail)

[Provide information on how and when this course will be assessed, e.g. by means of a written or oral exam, a report, a presentation, a project, group work assessment.]

OBSERVATIONS.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.

[Provide a list of the (most important) literature that students are required or recommended to read. Also, please make sure the required material is available in the other EUNICE universities and/or open source]

All lectures presentations and materials for the practical exercises/workshops will be available to Summer School participants on the Moodle platform.

Cynthis Leibrock and James Evans Terry "Beautiful Universal Design - A Visual Guide", John Wiley, 1998. ISBN: 0-4701-29306-7

Bonenberg A, Branowski B, Kurczewski P, et al. Designing for human use: Examples of kitchen interiors for persons with disability and elderly people. Hum. Factors Man.2019;29:177–186. https://doi.org/10.1002/hfm.20772

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D. A. Winter, *Biomechanics and Motor Control of Human Movement*, John Wiley & Sons, Inc., 2009

T. T. Dao, M. C. Ho Ba Tho, *Biomechanics of Musculoskeletal System. Modelling of Data Data Uncertainty and Knowledge*, ISTE Ltd and John Wiley & Sons, Inc, 2014

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D. B. Chaffin, *Digital Human Modeling for Vehicle and Workplace Design*, Society of Automotive Engineers (SAE) International, Warrendale, PA, 2001, ISBN: 0768006148, 9780768006148

V. G. Duffy (Ed.), Handbook of Digital Human Modeling: Research for Applied Ergonomics and Human Factors Engineering, CRC Press, Boca Raton, FL, 2008, ISBN: 9781420063523

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Esteva A., Robicquet A., Ramsundar B., et al. *A Guide to Deep Learning in Healthcare*. Nature Medicine, 25(1), 2019, pp. 24–29.