COURSE OUTLINE

(1) GENERAL

SCHOOL	Social Sciences		
ACADEMIC UNIT	Department of Cultural Technology and Communication		
LEVEL OF STUDIES	Postgraduate Studies		
COURSE CODE	UA-EC2	**SEMESTER**	2
COURSE TITLE	Circular Economy and Digital Health		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, state the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail in section (4).		3	6
COURSE TYPE *general background, special background, specialization, general education, skills development*	specialised general knowledge, skills development (technical)		
PREREQUISITE COURSES	No		
LANGUAGE OF INSTRUCTION AND OF ASSESSMENT	English		
MODE OF TEACHING *in-person (%) synchronous distance learning (%) asynchronous distance learning (%) (In the case of synchronous distance learning, the total weekly duration of teaching is recorded)*	The course is delivered exclusively through synchronous distance learning. Each weekly lecture lasts 180 minutes.		
AVAILABILITY TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	TBA		

(2) LEARNING OUTCOMES

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Brief Guide for drafting Learning Outcomes*

After the successful completion of the course, the student will be able to:
In terms of knowledge:

- Critically evaluate core circular economy principles and explain how they apply to digital health products, services, and healthcare value chains.
- Analyse how digital technologies (IoT, AI, digital twins, smart textiles, lifecycle data platforms) enable circular strategies across the medical device lifecycle.
- Explain international and European standards and policy frameworks relevant to circular digital health (e.g., ISO 59000/59020, HL7, ISO/IEEE 11073, DPP, UDI) and their role in driving sustainability.
- Evaluate ethical, legal, accessibility and data-governance implications of circular digital health, including disability inclusion, cybersecurity, and digital trust in device and data circulation.

- Assess the circular performance of healthcare operations and supply chains using standards-based indicators and propose strategies for improving resource efficiency and waste reduction.

In terms of skills:

- Design circular business model canvases for digital health services (e.g., device-as-a-service, sharing platforms, refurbishment and take-back schemes).
- Map and analyse stakeholder ecosystems and value chains for circular digital health offerings, identifying material, data, and value flows and potential circular loops.
- Integrate digital twins, AI, lifecycle traceability tools (DPP, UDI, IoT, blockchain) and CE standards into conceptual architectures for circular healthcare systems.
- Develop governance and service-model solutions that embed accessibility, privacy, and data traceability for users with disabilities within circular digital health ecosystems.

In terms of responsibility and autonomy:

- Drive strategic innovation initiatives that align circular economy goals with digital health transformation at organisational or ecosystem level.
- Take responsibility for ethical, inclusive, and sustainable decision-making in circular digital health, balancing efficiency with patient, societal, and environmental wellbeing.
- Manage cross-functional implementation projects introducing circular practices in healthcare supply chains and facilities, coordinating diverse clinical, technical, and managerial stakeholders.
- Apply critical judgement in evaluating cybersecurity, risk and digital-trust frameworks when devices and data circulate across users, facilities and life cycles.
- Coordinate research and innovation roadmaps for future circular digital health, identifying gaps, priorities, and partnerships that advance sustainable, data-driven healthcare.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and are stated below), at which of the following does the course aim?

Search, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adaptability to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Other…*
	…….

The current course will enable students to acquire the following competences:

- Decision-making, as students must evaluate circularity options, assess business-model trade-offs, make evidence-based choices about lifecycle management, and determine appropriate digital-health strategies.
- Effective communication and presentation of ideas to diverse professional audiences, as circular digital health involves stakeholders with very different expertise.
- Criticism and self-criticism, as UA-EC2 requires continuous evaluation of model limitations, device-reuse risks, accessibility gaps, cybersecurity weaknesses, and environmental trade-offs.
- Project planning and management, as students design circular business models, map value chains, evaluate supply-chain transformations, and orchestrate digital-health lifecycle improvements.
- Adapting to new situations, as circular digital health is dynamic: device reuse, remanufacture, service-based models, evolving regulatory frameworks, rapid technology shifts (DPP, UDI, AI-assisted diagnostics).

(3) COURSE SYLLABUS

In **UA-EC2: Circular Economy and Digital Health**, the students will learn how circular economy principles can be applied to the healthcare sector to enhance sustainability. The course explores digital tools for managing medical device lifecycles, improving resource use in healthcare systems, and reducing waste. The focus is on sustainable healthcare practices and innovative solutions for reusing and recycling healthcare products.

The course consists of 13 lectures, as presented below:

1. **Introduction to the circular economy in digital health (Instructor: ENDO).** This lecture introduces the core principles of the circular economy and explains their relevance to digital health systems and technologies. Students examine environmental impacts, value-creation opportunities, and the roles of stakeholders across healthcare ecosystems.
2. **Digital technologies as enablers of circularity (Instructor: ENDO).** This lecture explores how digital technologies—such as IoT, AI, big data, and smart textiles—support circular strategies in healthcare. Students learn the mechanisms through which digitalisation enables reuse, remanufacturing, and digital-service models.
3. **Digital twins and data-driven circular healthcare systems (Instructor: UNL).** This lecture examines how digital twins, lifecycle data platforms, and predictive analytics can enhance circularity in healthcare. Students analyze how real-time data improves asset management, device refurbishment, and waste reduction.
4. **AI and predictive analytics for circular healthcare systems (Instructor: UNL).** This lecture explores the role of AI and predictive analytics in improving resource efficiency and enabling circular processes in healthcare. Students learn how algorithmic insights support device lifecycle optimisation and clinical-operations sustainability.
5. **Business models and value chains for circular digital health services (Instructor: CEF).** This lecture analyses circular business models in digital health, including device-as-a-service, refurbished fleets, and sharing platforms. Students map stakeholder ecosystems, evaluate revenue models, and design business-model canvases for circular digital-health services.
6. **Strategic innovation and circular value in the digital health ecosystem (Instructor: EPBS).** This lecture examines how strategic innovation and management principles accelerate the transition toward circular, digital, and sustainable healthcare systems. Students explore EU policy frameworks, global dynamics, and cross-sector collaborations shaping digital-health transformation.
7. **Driving sustainability in the healthcare sector through circular economy standards (Instructor: CYS).** This lecture presents key CE and health-informatics standards (ISO 59000, ISO 59020, HL7, ISO/IEEE 11073) and explains how they foster sustainability in healthcare. Students learn how to improve device lifecycle management, interoperability, procurement, and resource efficiency.
8. **Digital health, accessibility and data governance for people with disabilities (Instructor: CEF).** This lecture investigates how digital health systems intersect with accessibility, disability inclusion, data governance, and circularity. Students analyse inclusive design principles, privacy/traceability requirements, and circular lifecycle models for disability-focused digital-health devices and apps.
9. **Cybersecurity, digital trust and risk management in circular digital health systems (Instructor: UNL).** This lecture explores how cybersecurity, digital trust, and risk-management frameworks must adapt when devices and data circulate across users and facilities. Students assess vulnerabilities, regulatory obligations, and trust-building mechanisms for safe circular digital-health systems.
10. **Implementing circular economy in healthcare supply chains (Instructor: ENDO).** This lecture focuses on practical applications of circular economy principles across healthcare supply chains, supported by Industry 4.0 technologies. Students study circular business models, sustainable procurement, reverse logistics, and digital tools enabling material recovery.
11. **Sustainable operations and resource-efficient healthcare facilities (Instructor: UNINOVA).** This lecture examines how hospitals and healthcare facilities can adopt sustainable and circular operational practices. Students explore strategies for

energy optimisation, green procurement, water circularity, waste minimisation, and digital resource-management systems.

12. **Digital Product Passports and lifecycle traceability for circular healthcare systems (Instructor: UNL).** This lecture introduces Digital Product Passports, UDI systems, IoT condition monitoring, and blockchain provenance for traceability in healthcare. Students learn how lifecycle data enables repair, reuse, refurbishment, and secure circular loops.
13. **Future directions and research trends in circular digital health (Instructor: ENDO).** This lecture reviews emerging research trends integrating digital and circular-economy paradigms in healthcare. Students explore current advancements, research gaps, and future agendas for sustainable digital-health transformation.

(4) TEACHING AND LEARNING METHODS - ASSESSMENT

MODE OF TEACHING *Face-to-face, distance learning, etc.*	Distance Learning
MODE AND FREQUENCY OF COMMUNICATION WITH THE STUDENTS	Synchronous distance communication on a weekly basis, asynchronous on a daily basis through LMS platform
ENSURING THE MODE OF COMMUNICATION AMONG STUDENTS *Team assignments and discussions, collaborative learning platforms with the use of AI, video conference, QA sessions, κ.α.*	Weekly assignments, discussions through dedicated discussion forum, dedicated space per module on the learning platform, schedule video conference meetings through MS Teams, dedicated QA sessions per module
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, in laboratory training, in the communication with students*	Use of ICT in Teaching, Communication with students Online Platforms will be used for teaching, tutorials, students' guidance, students' self-assessment and support on group projects
TECHNOLOGICAL EQUIPMENT REQUIREMENTS	PC /laptop for video conference meeting
PLAGIARISM POLICY/ PLAGIARISM DETECTION TOOLS	Gradescope, Turnitin
ARTIFICIAL INTELLIGENCE POLICY *(1) The use of Artificial Intelligence is prohibited in all circumstances* *(2) The use of Artificial Intelligence is allowed only with the permission of the instructor* *(3) The use of Artificial Intelligence is allowed only with an explicit reference to the literature* *(4) Students are free to use Artificial Intelligence*	The use of Artificial Intelligence is allowed only with an explicit reference to the literature. Additionally, students are free to use AI provided by the master programmes for contacting stimulations, practicing purposes, etc.
ORGANISATION OF TEACHING *The mode and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, work placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artworks, etc.* *The student's study hours for each learning activity are stated, as well as the hours of independent study, according to the principles of the ECTS.*	

Activity	***Semester workload***
Lectures	39
Participation in forum discussions	16,5
Study, analysis of bibliography and supplementary consolidation activities	73,5
Self-Assessment Evaluations	21
Course total	**150**

STUDENT ASSESSMENT *Description of the assessment method* *Language of assessment, methods of assessment, formative or summative assessment, multiple choice questions test, short answer questions, essay questions, problem solving, written work, essay/report,*	Students will be evaluated following multiple-choice, short-answer, and open-ended questions. The assessment formula is the following: Self-Assessment Evaluations: 50%

oral examination, public presentation, laboratory assignment, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Final Assessment: 50%

(5) RECOMMENDED BIBLIOGRAPHY

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