Table S2.6.4.en The template for preparation of course info lists

Course title: ***Energy and environmental refurbishment of buildings***

Course code	Course status	Semester	Number of ECTS credits	Class load
	Optional	I	10	2+2+0

Study programmes for which it is organised:
Doctoral studies in sustainable development, MARDS

Admission requirement: None

Goals of course: The goal of this course is to enable PhD students to become familiar with technical, environmental and cultural aspects of energy refurbishment of existing buildings. It is about elaboration of appropriate solutions and energy effects of thermal insulation of building envelope, related improvements of environmental parameters, including improvements of architectural aspects as a logical consequence of integrated refurbishment of buildings.

Course content:

Preparatory week	Consultation with supervisor, courses selection.
I week	Introduction. Establishing and development of discipline, terminology and technical regulation.
II week	Concept and content of energy refurbishment of a building. Concept founded on the natural coupling of energy and environmental aspects within energy efficiency of buildings.
III week	Technical aspects of energy renovation of buildings. Energy review of a building as approved methodology for calculating of energy performance of a building.
IV week	Analysis of principles, technical and technological solutions of implementation of thermal insulation in relation with space conditioning (heating and cooling) and specific requirements of characteristic elements of building envelope.
V week	Energy needs of a building for thermal energy as expression of architectural characteristics of a building and the structure of its envelope.
VI week	Environmental aspects of energy renovation of a building. Indicators of energy efficiency.
VII week	Effects of the reduction of thermal energy emitted by the energy efficient buildings. Implementation of renewable energy sources as integral aspect of energy efficiency.
VIII week	Architectural aspects of energy renovation of buildings. Potentials of interventions in the domain of improvements in architectural function and especially in building envelope.
IX week	Aspects of adjustment of technical solutions of the systems for space conditioning (heating, cooling and ventilation) with architecture of a building.
X week	Aspects of adjustment of technical solutions of the systems for renewable energy sources (solar hot water systems, photovoltaic systems) with architecture of a building.
XI week	Analysis of best practice examples – case study (consultations and discussion).
XII week	Analysis of best practice examples – case study (consultations and discussion).
XIII week	Analysis of best practice examples – case study through individual work (consultations).
XIV week	Individual analysis of best practice examples – case study through individual work
XV week	Individual analysis of best practice examples – review and discussion.

Teaching methods: teaching (lectures and exercises), in combination with supervised work; consultations; project based teaching/learning; practical work; obtained knowledge and skills presentation

Student's workload

Per week	**Per semester**
10 credits x 40/30 = **13.33 hours** Structure: **2** hours of lectures **2** hours of exercises **9.33** hours of individual work	**Lectures and final exam**: (13.33 hours) x 16 = **213.33 hours** **Necessary preparation** before the start of the semester (administration, enrolment, verification): (13.33 hours) x 2 = **26.66 hours** **Total workload for the course**: **10 x 30 = 300 hours** **Additional work** for preparing correction of the final exam,

	including taking the exam: **0 - 60 hours** (remaining time from the first and the second item to the total workload for the course of 300 hours) **Structure of the workload**: 213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

Obligations of students:

- regular attending lectures and other classes or adequate activity in supervised work
- conscientious and individual elaboration of homework and project tasks, as well as realisation of practical work through seminar paper, with systematisation of material and adequately applied scientific research methodology
- individual elaboration of written exam, accompanied by oral discussion
- presenting obtained knowledge during the semester and at the final exam

Literature:

- Direktiva 2010/31/EU Europskog parlamenta i vijeća (EPBD), Službeni list Europske unije L153/13, 2010.
- Pravilnik o minimalnim zahtjevima energetske efikasnosti zgrada, „Sl. list CG", broj 23/2013, Podgorica, 2013.; www.energetska-efikasnost.me
- Energetska efikasnost zgrada – Metodologija energetskog pregleda i proračuna indikatora EE, Mašinski fakultet i Arhitektonski fakultet UCG, Podgorica, 2011.
- Zbašnik Senegačnik M.: Pasivna kuća, SUN ARH doo, Zagreb, 2009.
- Brown G.Z., DeKay M.: Sun, Wind & Light – Architectural design strategies, John Wiley & Sons, Inc., New York, 2001
- Giebeler et al.: Refurbishment Manual – Maintanance, Conversions, Extensions; Birkhauser Basel Boston Berlin, Edition Detail Munich, 2009
- Current literature (scientific papers from international conferences and international journals)

Learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to:

- interpret concept and goals of energy efficiency of buildings in general terms and specific requirements of energy refurbishment of existing buildings,
- analyse energy review of a building as approved methodology for calculating of energy performance of a building,
- analyse principles, technical and technological solutions of implementation of thermal insulation in relation with space conditioning and specific requirements of characteristic elements of building envelope,
- reveal and assess energy needs of a building for thermal energy as expression of architectural characteristics of a building and the structure of its envelope,
- reveal and assess environmental aspects of energy renovation of a building through indicators of energy efficiency,
- assess and evaluate role of architectural aspects in energy renovation procedures in terms of adjustment of technical solutions of the systems for space conditioning and the systems for renewable energy sources with architecture of a building.

Transferable / Key skills and other attributes:

- Communication skills: oral defence of seminar paper, manner of expression at written examination.
- Use of information technology: use of software tools in analysis and calculation of energy efficiency.
- Analysis skills: application of appropriate analysis in solving of a building energy refurbishment.
- Understanding and interpretation of problem: defining of the content of a building energy refurbishment.

Methods of knowledge assessment and marking:

Knowledge assessment is continuous during the semester, through pre-exam checks, and in the final exam. In total, student may collect max 100 points. The following is assessed:

- seminar paper and other semester activities (homework etc.) 50%,
- final exam 50%.

The final exam consists of written and oral part. Written part may be realised through project task.
Grades (A, B, C, D, E, F) are adjoined to collected number of points, in line with the Law of Higher Education and study rules at the University of Montenegro.

Name and surname of professor who prepared course info-list:

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Special notes for the course:

Any other note: