MODULE OUTLINE EPK53

1. GENERAL INFORMATION

SCHOOL	OF APPLIED ARTS AND SUSTAINABLE DESIGN		
PROGRAM COURSE	SUSTAINABLE INTERIOR DESIGN OF BUILDINGS (EPK)		
LEVEL OF STUDY	POSTGRADUATE		
MODULE CODE	EPK53	**SEMESTER OF STUDY**	2nd
MODULE TITLE	**Heating – Cooling**		
INDEPENDENT TEACHING ACTIVITIES *in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits*		**HOURS**	**CREDIS**
Weekly teaching hours 21-23 hours x 13 weeks		**280-300**	**10 ECTS**
COURSE TYPE Compulsory, Optional, Optional mandatory	Compulsory		
PREREQUISITE MODULES:	None		
LANGUAGE OF INSTRUCTION AND EXAMS	Greek		
THE MODULE IS OFFERED TO ERASMUS STUDENTS	No (due to annual duration of the module)		
MODULE WEBSITE (URL)	https://www.eap.gr/en/viosimos-shediasmos/topics/#EPK53 Each module has its own space in the Learning Management System of EAP (https://courses.eap.gr/login/index.php), with controlled access (use of code) for students and teaching staff.		

2. LEARNING OUTCOMES

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:

Upon successful completion of the T.U., students will be able to:

- Recognize the structure of the various different Heating and/or Cooling systems, as well as the main components that make them up (production system, distribution system, terminal unit system)
- Describe in detail modern and innovative heating and/or cooling and/or electricity producing systems, with particular emphasis on the incorporation of Renewable Energy Sources.
- Analyze energy recovery (heat / cooling) possibilities when designing new building units or renovating / energy upgrading existing installations – building units.
- Analyze the capabilities of automation / regulation / monitoring systems in achieving and maintaining the desired comfort conditions per zone of use and building unit, as well as improve the energy efficiency of systems in variable interior and/or exterior environmental conditions.
- Understand the composition, basic structure, requirements (spatial and otherwise), advantages and disadvantages of heating/cooling/electricity systems evaluated or proposed during the planning, design and implementation phases of new buildings and the renovation of existing installations.

- Participate in a functional, efficient and modern interdisciplinary construction project design and management team.

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

Search for, analysis and synthesis of data and information by the use of appropriate technologies,
Adapting to new situations
Decision-making
Individual/Independent work
Group/Team work
Working in an international environment
Working in an interdisciplinary environment
Project planning and management
Respect for diversity and multiculturalism
Environmental awareness
Social, professional and ethical responsibility and sensitivity to gender issues
Critical thinking
Development of free, creative and inductive thinking
……
(Other…….citizenship, spiritual freedom, social awareness, altruism etc.) …….
Introduction of innovative research

- Search for, analysis and synthesis of data and information by the use of appropriate technologies
- Project planning and management
- Environmental awareness
- Adapting to new situations
- Decision-making
- Individual/Independent work
- Critical thinking
- Group/Team work
- Working in an interdisciplinary environment

3. MODULE CONTENT

The TU aims to provide students with the basics of design, evaluation and energy upgrading of heating/cooling systems to achieve Nearly Zero Energy Building levels (nZEB) or Net Zero Energy Building levels (NZEB). The TU will cover heating, cooling systems and cogeneration systems, hot water boilers (Gas-fired, liquid fuel, biomass), heat pumps (Air/Air, Geothermal, High-Temperature Air/Water), Organic working fluid chillers, Absorption or Adsorption chillers, Cogeneration / Tri-generation units, passive and hybrid cooling systems (e.g. ground and evaporative cooling, ceiling fans), solar assisted systems (Solar Thermal, Solar Cooling, PV, etc.). Furthermore, the TU will cover topics on distribution systems, terminal units, hot / cold water networks (underfloor, wall-mounted hydronic, classic single-pipe, two-pipe, three-pipe), Air duct networks, VRV direct expansion networks, district heating / cooling, Fan coil-type terminal units, radiators etc. as well as heat recovery / cooling systems, composite waste heat utilization systems for heating / cooling and electricity production (ORC circuits), Energy storage systems. Finally, the corresponding automations with compensation, three-way/four-way, control valves, complex systems at building level (BMS, BEMS) will be analyzed.

4. TEACHING METHODS--ASSESSMENT

MODES OF DELIVERY *Face-to-face, in-class lecturing, distance teaching and distance learning etc.*	Distance education with five Group Counseling Meetings (OSS) during the academic year on weekends.
USE OF INFORMATION AND COMMUNICATION	We use : Remote meetings tools (cisco webex),

<table>
<tr><td>TECHNOLOGY
Use of ICT in teaching, Laboratory Education, Communication with students</td><td>Presentation software (e.g. power point),

Additionally, the students use office automation tools, web browsers and e-reader for digital books.</td></tr>
<tr><td>MODULE DESIGN
Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc

The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.</td><td>
<table>
<tr><th>Activity</th><th>Annual Workload</th></tr>
<tr><td>3 OSS (x 4 hours)</td><td>12</td></tr>
<tr><td>2 tutorial exercises (2 x 42.5 hours)</td><td>85</td></tr>
<tr><td>1 semester assignment</td><td>30</td></tr>
<tr><td>Examination</td><td>3</td></tr>
<tr><td>Individual study (21-23 hours x 13 weeks)</td><td>149-169</td></tr>
<tr><td>Total module workload (hours)</td><td>280-300</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS
Detailed description of the evaluation procedures.

Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other……etc.

Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students</td><td>Completion of written assignments during the academic semester which constitute a 40 percent of each student’s grade, if a pass is obtained in the final or repetitive examination. Final exam grades constitute a 60 percent of the students’ final course grade. For further information go to the <u>EAP Study Guide</u>.</td></tr>
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5. SUGGESTED BIBLIOGRAPHY

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Karellas S., Roumpedakis T., Tzouganatos N., Braimakis K. (2019). Solar Cooling Technologies (1st Edition). CRC Press/Taylor & Francis Group. ISBN-pbk: 9780367733179, e-ISBN: 9781315163178, 463 pages

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ASHRAE Standard 55-2020, Thermal Environmental Conditions for Human Occupancy (ANSI Approved)

IEA Task 53 - New Generation Solar Cooling & Heating Systems (PV or solar thermally driven systems)

BACnet Standard

Balaras C.A., Grossman G. et al. (2007). Solar air conditioning in Europe — an overview, Renewable and Sustainable Energy Reviews, 11(2), pp. 299-314 (https://doi.org/10.1016/j.rser.2005.02.003)

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ASHRAE Standards & Guidelines