MODULE OUTLINE EPK62

1. GENERAL INFORMATION

SCHOOL	OF APPLIED ARTS AND SUSTAINABLE DESIGN		
PROGRAM COURSE	SUSTAINABLE INTERIOR DESIGN OF BUILDINGS (EPK)		
LEVEL OF STUDY	POSTGRADUATE		
MODULE CODE	EPK62	**SEMESTER OF STUDY**	3rd
MODULE TITLE	**Heat / cooling systems**		

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	Elective
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/#EPK62 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 Thematic Laboratory Unit, students will be able to:

- Understand the utility of a reliable methodology to carry out, record and evaluate reliable experimental data in real installations.
- Utilize measurements in the verification, monitoring and calibration of the input parameters of advanced simulation / design software used at both the building level and at the level of individual Heating and/or Cooling Systems.
- Manage gaps in data regarding consumption / yield / real effective power level in existing installations to evaluate energy upgrade scenarios and bypass this obstacle to the entry into the market and use of innovative financial instruments such as energy service contracts.
- Evaluate (value, error, measurement uncertainty) and perform routine measurement of technical quantities, such as measuring air flow in ducts, surface temperature, humidity, pressure, exhaust gas quality, fuel flowrate, calculate energy flow using primary data/measurements, evaluate system status (power etc.) through measurement data, etc. with the use of scientific equipment.

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

This elective TLU aims to introduce students to the principles of technical quantity measurement, with emphasis on quantities related to heating and cooling systems and the use of the resulting data in the everyday life and work of engineers / designers / users.

4. TEACHING METHODS--ASSESSMENT

MODES OF DELIVERY *Face-to-face, in-class lecturing, distance teaching and distance learning etc.*	Distance education with three Group Counseling Meetings (OSS) during the academic year on weekends. Personal communication and feedback, where necessary (advisory role of SEP members)
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY *Use of ICT in teaching, Laboratory Education, Communication with students*	We use : Remote meetings tools (cisco webex), Presentation software (e.g. power point), Use of appropriate equipment for surface temperature measurement, humidity measurement, pressure measurement, exhaust gas quality measurement Additionally, the students use office automation tools, web browsers and e-reader for digital books.
MODULE DESIGN *Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art*	

Activity	***Annual Workload***
3 OSS (x 4 hours)	12

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.*	2 tutorial exercises (2 x 30 hours)	60
	Final Examination (Written examination or Final written assignment)	58
	Individual study (12-13 hours x 13 weeks)	150-170
	Total module workload (hours)	**280-300**
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*	Completion of educational activities during the academic semester which constitute a 40 percent of each student's grade. Final Examination (Written examination or Final written assignment), which constitute a 60 percent of the students' final laboratory course grade. For further information go to the **EAP Study Guide**.	

5. SUGGESTED BIBLIOGRAPHY

Κορωνάκη Ειρ., Αντωνάκος Γ., Δαλαβούρας Δ., Δαλαβούρας Π. (2023). Ψύξη - Κλιματισμός Κτηρίων και Βιομηχανικών Εφαρμογών. Θεσσαλονίκη: εκδ. Τζιόλα. ISBN: 978-960-418-526-9, σελίδες 856

Κατσαπρακάκης Δ., Μονιάκης Μ. (2015). Θέρμανση - Ψύξη - Κλιματισμός. ISBN: 978-960-603-339-1, σελίδες 690 Κάλλιπος, Ανοικτές Ακαδημαϊκές Εκδόσεις.

ΤΟΤΕΕ 20701-1/2017. Αναλυτικές εθνικές προδιαγραφές παραμέτρων για τον υπολογισμό της ενεργειακής απόδοσης κτιρίων και την έκδοση του πιστοποιητικού ενεργειακής απόδοσης (σύμφωνα με την αναθεώρηση του Κ.ΕΝ.Α.Κ. 2017). Υπουργείο Περιβάλλοντος & Ενέργειας, ΤΕΕ.

Τ.Ο.Τ.Ε.Ε. 20701-4/2017. Οδηγίες και έντυπα ενεργειακών επιθεωρήσεων κτιρίων, συστημάτων θέρμανσης και συστημάτων κλιματισμού (σύμφωνα με την αναθεώρηση του Κ.ΕΝ.Α.Κ. 2017). Υπουργείο Περιβάλλοντος & Ενέργειας, ΤΕΕ.

ΤΟΤΕΕ 20701-6/2022. Βιοκλιματικός σχεδιασμός στον ελλαδικό χώρο

ΤΟΤΕΕ 20701-8/2021. ΕΓΚΑΤΑΣΤΑΣΕΙΣ ΑΞΙΟΠΟΙΗΣΗΣ ΑΝΑΝΕΩΣΙΜΩΝ ΠΗΓΩΝ ΕΝΕΡΓΕΙΑΣ ΣΕ ΚΤΙΡΙΑ

ASHRAE HANDBOOKS: REFRIGERATION 2022 Chapters: R-6 Refrigerant System Chemistry, FOUNDAMENTALS 2021 Chapters: F-7 Fundamentals of Control, F-17 & F-18 Load Calculations, F-28 Combustion and Fuels, F-29 and -30 Refrigerants HVAC SYSTEMS AND EQUIPMENT 2020 Chapter: S-18 Variable Refrigerantion Flow (VRF), S-32 Boilers, S-34 Residential in-space Heating Equipment, S-35 Chimney, Vent and Fireplace Systems, S-36 Hydronic Heat-Distributing nits and Radiators, S-37 Solar energy equipment and systems, S-38 Compressors, S-39 Condensers, S-40 Cooling towers, S-41

Evaporative Air-Cooling equipment, S-43 Liquid-Chilling Systems, S-50 Thermal storage (Επικοινωνία για οικονομική προσφορά αγοράς Κεφαλαίων από τα βιβλία της ASHRAE: Mr Mark Owen, ASHRAE Director of Publications and Education, USA Tel: 001-678 539 1187 mowen@ashrae.org)

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

Καρέλλας Σ., Κακαράς Ε., Ρουμπεδάκης Τ. (2022). Μεταφορά Θερμότητας και Μάζας από τη Φυσική στη Μηχανολογία. Αθήνα: εκδ. Τσότρας. ISBN: 978-618-5495-98-5, σελίδες 700

Παντελίδης, Γ. (2021). Νέος οδηγός ενεργειακής επιθεώρησης κτηρίων (3η έκδοση). Αθήνα: εκδ. Δεδεμάδη. ISBN: 978-618-5499-09-9, σελ. 675

ΘΕ 2 - Σχεδιασμός Εγκατάστασης Κεντρικής Θέρμανσης Κτηρίων, Ιούνιος 2011 Τεχνικό Επιμελητήριο Ελλάδας

ΘΕ 3 - Ηλεκτρικά Συστήματα και Διατάξεις Αυτομάτου Ελέγχου στις Εγκαταστάσεις Θέρμανσης, Ιούνιος 2011 Τεχνικό Επιμελητήριο Ελλάδας

ASHRAE Standard 15-2022, Safety Standard for Refrigeration Systems

ASHRAE Standard 34-2022, Designation and Safety Classification of Refrigerants

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)

Dascalaki, E. G., & Balaras, C. A. (2021). Impacts on Indoor Thermal Comfort and Heating Energy Use in Hellenic Dwellings from Occupant Behavioral Reactions. Applied Sciences, 11(14), 6254

Τάτσιος Αντ. (2022). Έξυπνα κτίρια: Υπολογισμός δείκτη ευφυούς ετοιμότητας (SRI) σε κτίριο γραφείων. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Πολυτεχνική Σχολή, Τμήμα Μηχανολόγων Μηχανικών

ASHRAE Standards & Guidelines