COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	EN0302	**SEMESTER**	6th
COURSE TITLE	HEAT TRANSFER APPLICATIONS		

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, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Practical Exercises	5	6
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Scientific area, Skills development
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (tutoring)
COURSE WEBSITE (URL)	https://www.mie.uth.gr/?page_id=18361&lang=en

(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*
- *Guidelines for writing Learning Outcomes*

This course aims to extend students' theoretical and technological background in thermal radiation heat transfer and multimode heat transfer applications including solar thermal systems, condensation/boiling, food refrigeration, electronics cooling and human thermoregulation. Following the successful completion of the course it is expected that the students are able to apply heat transfer analysis to solve problems in several mechanical engineering applications. Also, they will be able to:

- Define and successfully apply heat transfer models in engineering problems
- Apply and develop solar-thermal systems software
- Investigate physical phenomena based on numerical solutions

General Competences

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

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

- Retrieve, analyze and synthesize data and information, with the use of necessary technologies
- Decision Making
- Project management

- Exercise judgement and self-evaluation
- Development of innovative and inductive thinking
- Adjustment to new conditions/situations
- Autonomous Work
- Team Work

(3) SYLLABUS

1. Thermal radiation: Spectrum of electromagnetic radiation, Blackbody radiation, Planck's spectral distribution and Stefan-Boltzmann law, Definitions of power and intensity of radiation, Properties of Nonblack surfaces, Spectrum of solar radiation.
2. Thermal radiation heat transfer: View factor, Radiation exchange in enclosures composed of a) black surfaces, b) diffuse-gray surfaces, c) nondiffuse-nongray surfaces, Radiation shields.
3. Multimode heat transfer: Heat transfer by radiation combined with conduction and convection.
4. Solar thermal systems: Detailed design of solar collectors, Storage of thermal energy, Sizing solar systems (f-Chart method), Economics, Operation and control, Case studies.
5. Food cooling and freezing.
6. Condensation and boiling heat transfer: Types of boiling, Pool boiling, Nukiyama's boiling curve, Nucleate boiling, Film boiling, Free and forced convection boiling, Condensation modes, Film condensation (laminar and turbulent) in vertical and horizontal surfaces, Dropwise condensation.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	In class lectures.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Usage of web pages Usage of power-point slides
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	
STUDENT PERFORMANCE EVALUATION ***Description of the evaluation procedure*** *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	I. Written final exam (50%) II. Homework (50%) The evaluation criteria are made known to the students at the beginning of the semester and are posted on the course's website.

Activity	*Semester workload*
Lectures	56
Self-evaluating exercises	38
Autonomous work	56
Course Total	***150***

(5) **ATTACHED BIBLIOGRAPHY**

Suggested bibliography

- Fundamentals of Heat and Mass transfer, F. Incropera, D.P. Dewitt, T.L. Bergman, A.S. Lavine, John Wiley & Sons, 2006.
- Thermal Radiation Heat Transfer, R. Siegel, J.R. Howell, McGraw Hill, 1981.
- Heat and Mass Transfer – Fundamentals & Applications,, Y.A. Cengel, A.J. Ghajar, McGraw-Hill Education, 6th ed., 2020.
- Convective Heat Transfer, L.C. Burmeister, John Wiley @ Sons, 1983.
- Solar Engineering of Thermal Processes, J.A. Duffie, W.A. Beckman, John Wiley & Sons, 1991.
- Solar-Thermal Energy, J.R. Howell, R.B. Bannerot, G.C. Vliet, McGraw Hill, 1982-