University of Split

University Department of Professional Studies

# HEATING AND AIR-CONDITIONING

## COURSE SYLLABUS

| COURSE DETAILS | | |
|---|---|---|
| *Type of study programme* | Specialist graduate professional study programme of Mechanical Engineering-12O ECTS | |
| *Study programme* | Mechanical Engineering | |
| *Course title* | Heating and Air-Conditioning | |
| *Course code* | DST005 | |
| *ECTS (Number of credits allocated)* | 6 | |
| *Course status* | Core | |
| *Year of study* | First | |
| *Semester* | First (fall) | |
| *Course Web site* | http://www.oss.unist.hr/ | |
| *Total lesson hours per semester* | Lectures | 30 |
| | Practicals + Seminars | 15 + 15 |
| | Laboratory exercises & practical demonstration | 0 |
| *Prerequisite(s)* | None | |
| *Lecturer(s)* | Department of Mechanical Engineering:<br>Zlatko Jankoski, Ph.D., College professor | |
| *Language of instruction* | Croatian, English | |

| COURSE DESCRIPTION | |
|---|---|
| *Course Objectives:* | - understanding of basic laws, principles and phenomena in the area of heating and air-conditioning,<br>- understanding of operational principles of technical systems for heating and air-conditioning,<br>- calculation of heating and cooling loads of simple buildings,<br>- dimensioning and design of simple heating and air-conditioning systems,<br>- selection of main elements of simple heating and air-conditioning systems. |
| *Learning outcomes*<br><br>*On successful completion of this course, student should be able to:* | 1. define basic terms, values and laws in the areas of heat exchange, heating and air-conditioning,<br>2. describe the operational principles of simple heating and air-conditioning systems,<br>3. analyse the operational parameters of simple heating and air-conditioning systems,<br>4. calculate the energy requirements for heating and cooling of simple buildings,<br>5. use tables and diagrams, equations and empirical expressions necessary for dimensioning and design of simple heating and air-conditioning systems,<br>6. select engineering approach to problem solving based on the acquired physics and mathematical knowledge. |
| *Course content* | **Introduction:** Introduction to heating and air-conditioning. Physiologic-hygienic requirements. Climate-meteorological requirements. Thermodynamic parameters. The properties of water. Water as energy carrier. **Heating Load:** Heat losses. Heat gains. The calculation of heating load. Use of software for calculation of heating load. **Heating Systems:** Introduction. Types of heating systems. Techniques of heating. Primary and secondary sources of heat. District heating. Engine room. Heating elements. Surface heating. Basic elements of heating system. Safety of heating systems. Design of simple heating systems. **Domestic Hot Water:** General properties and requirements. Basic elements of DHW system. Design of simple DHW systems. **Cooling Load:** Basics on solar energy. Impact of solar energy on cooling load. Heat exchange – introduction. Internal sources of heat. The calculation of cooling load. Use of software for calculation of cooling load. **Moist Air:** Properties of moist air. Mollier diagram (enthalpy-entropy). Heating of moist air. Cooling of moist air. Mixing of air streams. Mixing of water and moist air. Preparation of air for air-conditioning. **Air-conditioning:** Introduction. Types of air-conditioning systems. Distribution of air in air-conditioning systems. Air flow - properties and requirements. Main elements of air distribution system. **Cooling systems:** Sources of cooling |

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|---|---|
| | energy. Types of refrigerants. Cooling systems and elements. Direct and indirect cooling of air. Evaporative cooling of air. Air-conditioning units. Heat pumps. **Automatic Regulation:** Principles of automatic regulation. Measuring elements. Operating elements. Automatic regulation of simple systems (heating, air-conditioning). **Energy efficiency:** Principles of energy saving. Heat recovery/recuperation. Energy consumption. Energy labels. |

## CONSTRUCTIVE ALIGNMENT – Learning outcomes, teaching and assessment methods

| **Alignment of students activities with learning outcomes** | | |
|---|---|---|
| **Activity** | **Student workload ECTS credits** | **Learning outcomes** |
| *Lectures* | **30 hours / 1 ECTS** | **1,2,3,5,6** |
| *Practicals* | **15 hours / 0,5 ECTS** | **1,4,5,6** |
| *Seminar* | **15 hours / 0,5 ECTS** | **1,2,3,4,5,6** |
| *Seminar Thesis (preparation and delivery)* | **75 hours / 2,5 ECTS** | **1,2,3,4,5,6** |
| *Self-study* | **30 hours / 1 ECTS** | **1,2,3,4,5,6** |
| *Office hours and final exam* | **15 hours / 0,5 ECTS** | **1,2,3,4,5,6** |
| **TOTAL:** | **180 hours / 6 ECTS** | **1,2,3,4,5,6** |

| **CONTINUOUS ASSESSMENT** | | |
|---|---|---|
| **Continuous testing indicators** | **Performance $A_i$ (%)** | **Grade ratio $k_i$ (%)** |
| *Attendance and activities during lectures* | **70-100** | **40** |
| *Attendance and activities during practicals* | **70-100** | **60** |

| FINAL ASSESSMENT | | |
|---|---|---|
| **Testing indicators – final exam (first and second exam term)** | **Performance $A_i$ (%)** | **Grade ratio $k_i$ (%)** |
| *Seminar Thesis (written)* | **50 - 100** | **30** |
| *Seminar Thesis (oral)* | **50 - 100** | **30** |
| *Theoretical exam (oral)* | **50 - 100** | **30** |
| *Previous activities (include all continuous testing indicators)* | **70 - 100** | **10** |
| **Testing indicators – makeup exam (third and fourth exam term)** | **Performance $A_i$ (%)** | **Grade ratio $k_i$ (%)** |
| *Seminar Thesis (written)* | **50 - 100** | **30** |
| *Seminar Thesis (oral)* | **50 - 100** | **30** |
| *Theoretical exam (oral)* | **50 - 100** | **30** |
| *Previous activities (include all continuous testing indicators)* | **70 - 100** | **10** |

| PERFORMANCE AND GRADE | | |
|---|---|---|
| **Percentage** | **Criteria** | **Grade** |
| **50% - 61%** | *basic criteria met* | **sufficient (2)** |
| **62% - 74%** | *average performance with some errors* | **good (3)** |
| **75% - 87%** | *above average performance with minor errors* | **very good (4)** |
| **88% - 100%** | *outstanding performance* | **outstanding (5)** |

## ADDITIONAL INFORMATION

Teaching materials for students (scripts, exercise collections, examples of solved exercises), teaching record, detailed course syllabus, application of e-learning, current information and all other data are available by MOODLE system to all students.