# POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

## COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

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| **1. GENERAL COURSE INFORMATION** | | | | |
| **1.1 Course name** | **Thermotechnical system management** | | | |
| **1.2 Study program/s** | Undergraduate professional study Sustainable Development | | | |
| **1.3 Course status (O,E)** | Obligation | **1.6 Mode of instruction (number of hours)** | **Lectures** | 15 |
| **1.4 Course code** | | | **Exercises** | 30 |
| **1.5 Course abbreviation** | TSM | | **Seminars** | |
| **1.6 Semester** | VI | | **E-learning** | |
| **1.7 ECTS** | 4 | **1.7 Place and time of instruction** | Premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website | |
| **2. TEACHING STAFF** | | | | |
| **2.1 Course leader/s-title** | prof. dr. sc. Budimir Mijović | **contact** | budimir.mijovic@mev.hr | |
| | - - - | **contact** | ---- | |
| **2.2 Assistant/s- title** | | **contact** | | |
| | - - - | **contact** | - - - | |
| **2.3 Instruction held by- title** | - - - | **contact** | - - - | |
| **3. COURSE DESCRIPTION** | | | | |
| **3.1 Course goals** | The aim of the course is the acquisition of basic knowledge and education of students of thermotechnical engineering in the professional field of Thermotechnical System Management. | | | |
| **3.2 Prerequisites** | Passed the course Heating and Air Conditioning | | | |
| **3.3 Course outcomes** | After successfully passing the course, the student will be able to:<br><br>1. Interpret and valorize the management of heating, air conditioning and ventilation installations.<br>2. Calculate the operating parameters of cooling devices.<br>3. Identify and valorize the refrigeration system.<br>4. Explain and investigate heat and cooling energy accumulators in buildings.<br>5. Identify, isolate and estimate heat losses of heating and cooling in building.<br>6. Select and apply the mode of operation of new heat and cooling energy systems.<br>7. Plan and apply the method of choosing energy saving equipment.<br>8. Analyze, evaluate and develop the heat balance of the thermotechnical system with optimal energy consumption.<br>9. Predict and calculate the elements of energy efficient technologies.<br>10. Expose and manage activities related to the management of heating installations. | | | |
| **3.4 Course content** | The course presents contents related to the management of heating installations, as well as air conditioning and ventilation. | | | |

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| **3.5 Types of coursework** | x | Lectures | x | Exercises | x | Blended e-learning | x | Individual activities | | Laboratory |

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| | x | Seminars and workshops | x | Distant learning | x | Field classes | x | Multimedia and network | x | Mentorship |
| | | Other | | | | | | | | |

**3.6 Language of instruction**

Croatian / English

**3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)**

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| 2,0 | Class attendance | 0,3 | Seminars | | Essay |
| 0,3 | Class activity | 0,3 | Project | | Report/paper |
| | Midterm exams | 0,3 | Practical task | 0,3 | Continuous knowledge check |
| 1,0 | Written exam | | Experimental work | | |
| 0,5 | Oral exam | | Research | | |

**3.8 Assessment and evaluation of students' work during classes and at the final exam**

| Activity specification | Percent % | Points |
|---|---|---|
| Assessment during instruction | | |
| Attendance | 5% | 5 |
| Class activity | 5% | 5 |
| Project / Practical work | 20% | 20 |
| Seminar / Colloquium I | 20% | 20 |
| Seminar / Colloquium II | 20% | 20 |
| Oral exam | 30% | 30 |
| *Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester* | | |
| *Written exam* | *60%* | *60* |
| **Total:** | **100%** | **100** |

**3.9 Assessment criteria – analysis per learning outcomes**

| **Ways of evaluating learning outcomes** | | | | | | | |
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| | **Atten-dance** | **Activity** | **Project** | **Mid-term exam 1** | **Mid-term exam 2** | **Practic work** | **Total** |
| Outcome 1 | | | 2 | 4 | | 3 | 9 |
| Outcome 2 | | | 2 | 4 | | 3 | 9 |
| Outcome 3 | | | 2 | 4 | | 3 | 9 |
| Outcome 4 | | | 2 | 4 | | 3 | 9 |
| Outcome 5 | | | 2 | 4 | | 3 | 9 |
| Outcome 6 | | | 2 | | 4 | 3 | 9 |
| Outcome 7 | | | 2 | | 4 | 3 | 9 |
| Outcome 8 | | | 2 | | 4 | 3 | 9 |
| Outcome 9 | | | 2 | | 4 | 3 | 9 |
| Outcome 10 | | | 2 | | 4 | 3 | 9 |
| Outcome not-related | 5 | 5 | | | | | 10 |
| **Total** | **5** | **5** | **20** | **20** | **20** | **30** | **100** |

The course has defined 10 learning outcomes, a system of scoring outcomes, in order to pass the exam the student must achieve at least 50% points for each learning outcome.

The grade is calculated as follows:

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| | • 87.51-100.00 points: rating Excellent (5)<br>• 75.01- 87.5 points: rating Very good (4)<br>• 62.51 -75.00 points: rating Good (3)<br>• 50.01- 62.5 points: rating Pass (2)<br>• 00.00- 50.00 points: rating Fail (1) | |
| **3.10 Specific features related with taking the course** | If the student collects 50% of the points of each outcome, he / she directly takes the exam, provided that he / she has done practical work (seminars / project). During the exam, it is possible to orally check the knowledge from practical work (seminars / project).<br>Once earned points for each learning outcome are no longer deleted unless the student, with the express approval of the course leader, decides to correct the result for each learning outcome, whereby the points won are deleted and newly earned points for that learning outcome are entered. The final grade is obtained on the exam period and is the sum of points earned during classes.<br>Students who did not take the colloquium access the written part of the exam where all learning outcomes are checked, and are required to have completed practical work (seminars / project) before taking the exam. | |
| **3.11 Students obligations** | Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam.<br>Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam.<br>If the student has not fulfilled all the obligations set by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam.<br>Attendance can be offset by online tuition, organised webinars and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason/apology, the request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader. | |
| **3.12 Written assignments** | Seminars / Projects | |
| **3.13 Required reading** | 1. | F. Bošnjaković: Nauka o toplini, 3 dio, Tehnička knjiga, Zagreb, 1986. ISBN 86-7059-017-4 |
| | 2. | I. Galaso: Određivanje toplinskog opterećenja prostorije, Zagreb, 1992 |
| | 3. | P. Donjerković: Osnove regulacije sustava grijanja, ventilacije i klimatizacije, Alfa Zagreb, 1996 |
| | 4. | Recknagel-Sprenger: Priručnik za grijanje i klimatizaciju, Oldenbourg 2004 |
| **3.14 Additional reading** | 1. | Propisi Hrvatske norme, pravilnici i smjernice za izvođenje, nadzor i puštanje u rad instalacija |
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| **4 ADDITIONAL COURSE INFORMATION** | | |
| **4.1 Quality control** | | |

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| | The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec. |
| **4.2 Contact the teacher** | Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is possible to ask questions and e-mail which will be answered as soon as possible. |
| **4.3 Information about the course** | It is the obligation of each student to be regularly informed about the course. All relevant information and notices related to classes and exams, maintenance or any year, will be reported in a timely manner on the bulletin board and on the website of the Polytechnic of Međimurje in Čakovec. |
| **4.4 Course contribution to the study program** | Course contribution to the study program in generic learning outcomes;<br><br>I1 - Interpret information, ideas, problems and solutions to professional and general audience,<br>I2 - Use new technologies and techniques as part of a lifelong process Learning,<br>I5 - Critically evaluate arguments, assumptions and data in order to create opinions and contributing to the solution of the problem.<br><br>The contribution of the course to the study program in specific learning outcomes;<br><br>I6 - Solve engineering problems of thermal networks using mathematics, physics, chemistry and biology,<br>I7 - Analyze collected data in the field of heating and air conditioning and ventilation,<br>I8 - Interdisciplinary to solve engineering problems of heating and air conditioning and ventilation,<br>I11 - Apply basics of thermoenergetics, thermodynamics and hydromechanics in spatial design of heating and air conditioning and ventilation systems,<br>I12 - Develop a technical plan in the field of design of mechanical heating systems and air conditioning and ventilation,<br>I13 - Analyze the basic elements and networks in electrical engineering and justify use of non-renewable and renewable energy sources, applicable code heating systems of heating systems and air conditioning and ventilation,<br>I14 - Apply and monitor conventional heating, cooling, and ventilation systems and devices,<br>I15 - Maintain heating and air conditioning and ventilation systems and systems,<br>I16 - Propose technical changes and upgrades to the heating system and air conditioning and ventilation in the direction of sustainable development. |

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**5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)**

**LECTURES**

| Hours | Topic and description | **Method**<br>• Direct teaching (lecture, instruction, pp presentation)<br>• Discovery learning (individual, lead, discussion)<br>• Group learning<br>• Case study<br>• Field classes… | Learning outcomes | Course outcome |
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| **1.** | Introduce students to the lecture program, teaching conditions, literature and criteria for evaluating knowledge. Development and perspective, historical overview of the development of heating systems and air conditioning and ventilation on the development of society | Lecture, Discovery learning, Presentation | Use knowledge of historical development and future perspective projections of technical heating systems and air conditioning and ventilation | I1 |
| **2.** | Types of heating and air conditioning and ventilation systems and features, Example of heating and air conditioning and ventilation systems, Parameters of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Distinguish models of heating systems and air conditioning and ventilation and features of heating systems | I1 |
| **3.** | Elements of heating systems and air conditioning and ventilation. | Lecture, Discovery learning, Presentation | Distinguish the elements of heating and air conditioning and ventilation | I2 |
| **4.** | The principle of heat required for heating systems and air conditioning and ventilation | Lecture, Discovery learning, Presentation | Use the principles of heat needed for heating and air conditioning and ventilation | I3 |
| **5.** | The principle of heat loss in heating and air conditioning and ventilation systems | Lecture, Discovery learning, Presentation | Use the principles of heat loss in heating and air conditioning and ventilation systems | I4 |
| **6.** | Basic concepts of monitoring and measuring the process of heating | Lecture, Discovery learning, Presentation | Distinguish the basic concepts of monitoring and | I5 |

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| | systems and air conditioning and ventilation. | | measuring the heating process and air conditioning and ventilation | |
| **7.** | Thermotechnical characteristics of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply and distinguish the input and output characteristics of heating systems and air conditioning and ventilation | I5 |
| **8.** | Thermotechnical characteristics of heat for heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply and distinguish heat input and output characteristics for heating and air conditioning and ventilation systems | I5 |
| **9.** | Thermotechnical characteristics of individual heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply and distinguish the input and output characteristics of heating systems and air conditioning and ventilation | I5 |
| **10.** | Features and examples of different heating and air conditioning and ventilation systems | Lecture, Discovery learning, Presentation | Apply and distinguish the features of heating systems and air conditioning and ventilation | I6 |
| **11.** | Heating and air conditioning and ventilation systems, Examples. | Lecture, Discovery learning, Presentation | Exemplary differentiation of heating and air conditioning and ventilation systems | I7 |
| **12.** | Pipelines and fittings for heating and air conditioning and ventilation. | Lecture, Discovery learning, Presentation | Explain pipelines and fittings in heating and air conditioning and ventilation systems | I7 |
| **13.** | Efficient technologies in heating and air conditioning and ventilation systems | Lecture, Discovery learning, Presentation | Explain effective technologies in heating and air conditioning and ventilation systems | I8 |
| **14.** | Structural elements of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Explain the construction elements of heating and air conditioning and ventilation systems | I9 |

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| **15.** | District heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply engineering of thermotechnical heating systems and air conditioning and ventilation | I10 |
| **EXERCISES/ SEMINARS** | | | | |
| **Hours** | **Topic and description** | **Method**<br>• Direct teaching (lecture, instruction, pp presentation)<br>• Discovery learning (individual, lead, discussion)<br>• Group learning<br>• Case study<br>• Field classes… | **Learning outcomes** | **Course outcome** |
| **1.** | Introduce students to the lecture program, teaching conditions, literature and criteria for evaluating knowledge. Development and perspective, historical overview of the development of heating systems and air conditioning and ventilation with an impact on the development of society | Lecture, Discovery learning, Presentation | Apply knowledge of historical development and future perspective projections of technical heating systems and air conditioning and ventilation | I1 |
| **2.** | Types of systems and features of heating and air conditioning and ventilation, Example of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Explain system models and features of heating and air conditioning and ventilation. | I1 |
| **3.** | It manages the installations of heating systems and air conditioning and ventilation. | Lecture, Discovery learning, Presentation | Explain the principles and operating parameters of heating systems and air conditioning and ventilation | I2 |
| **4.** | The principle of heat transfer required for heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply the principles of heat required for heating and air conditioning and ventilation systems | I3 |
| **5.** | The principle of heat loss in heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Explain the principles of heat loss in heating systems and air conditioning and ventilation | I4 |

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| **6.** | Basic concepts of monitoring the process of heating systems and air conditioning and ventilation. | Lecture, Discovery learning, Presentation | Derive the basic concepts of monitoring and measuring the process of technical heating system and air conditioning and ventilation | I5 |
| **7.** | Thermotechnical characteristics of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply and distinguish the input and output characteristics of heating systems and air conditioning and ventilation | I5 |
| **8.** | Thermotechnical characteristics of heat for heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply and distinguish heat input and output characteristics for heating and air conditioning and ventilation systems | I5 |
| **9.** | Thermotechnical characteristics of heating bodies in a heating system. | Lecture, Discovery learning, Presentation | Apply and distinguish the input and output characteristics of radiators in the heating system | I5 |
| **10.** | Features and examples of heating and air conditioning and ventilation systems management. | Lecture, Discovery learning, Presentation | Apply and distinguish the control features of the heating system and air conditioning and ventilation | I6 |
| **11.** | Pipelines and pipe fittings for heating and air conditioning and ventilation systems, Examples. | Lecture, Discovery learning, Presentation | Explain the differences in the management of heating systems and air conditioning and ventilation | I7 |
| **12.** | Thermal balance of thermotechnical heating control system and air conditioning and ventilation. | Lecture, Discovery learning, Presentation | Explain the heat balance of the heating control system and air conditioning and ventilation | I7 |
| **13.** | Efficient technologies in the management of heating systems and air conditioning and ventilation. | Lecture, Discovery learning, Presentation | Explain effective technologies in the management of heating and air conditioning and ventilation systems | I8 |

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| **14.** | Structural elements of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply the building elements of the heating system and air conditioning and ventilation | I9 |
| **15.** | Remote control of heating and air conditioning and ventilation systems. | Lecture, Discovery learning, Presentation | Apply engineering of thermotechnical heating systems and air conditioning and ventilation | I10 |