

Cracow University of Technology

## Course syllabus

binding for the doctoral students of the CUT Doctoral School commencing their studies  
in the academic year 2022/2023

### Information on the course

|  |   |
|--|---|
| Name of the course in Polish                 | Termodynamika techniczna  |
| Name of the course in English                | Technical thermodynamics  |
| Number of the ECTS points                    | 1   |
| Language of instruction                      | Polish  |
| Category of the course                       | Choosable   |
| Field of education                           | Engineering and technology  |
| Discipline of education                      | Mechanical engineering  |
| Person responsible for the course<br>Contact | Prof. Piotr Cyklis, <i>doctor habilitatus</i><br>piotr.cyklis@pk.edu.pl |

### Type of course, number of hours in the study programme curriculum

| Semester   | Credit type<br>(G / NG)* | Lecture | Practical<br>classes | Laboratory | Computer<br>Lab | Project Class | Seminar |
|------------|--------------------------|---------|----------------------|------------|-----------------|---------------|---------|
| 2, 3, 4, 5 | G                        | 15      | 0                    | 0          | 0               | 0             | 0       |

\*G – graded credit, NG – non-graded credit

### Course objectives

| Code        | Objective description   |
|-------------|---|
| Objective 1 | Introduction to the current problems of practical thermodynamics.           |
| Objective 2 | Introduction to the current problems of thermodynamics in scientific terms. |

### Learning outcomes

| Code                                 | Description of the learning outcome adjusted to the specific characteristics of the discipline                         | Learning outcome symbol in the CUD DS | Methods of verification             |
|--------------------------------------|--|---------------------------------------|-------------------------------------|
| <b>OUTCOMES RELATED TO KNOWLEDGE</b> |  |                                       |                                     |
| EUW1                                 | The doctoral student knows and understands the impact of thermodynamics on energy and its impact on the modern economy | E_W01,<br>E_W02                       | Responses to questions at lectures. |
| EUW2                                 | The doctoral student knows and understands the most important problems and issues of modern technical thermodynamics   | E_W01,<br>E_W02                       | Responses to questions at lectures. |
| <b>OUTCOMES RELATED TO SKILLS</b>    |  |                                       |                                     |
| EUU1                                 | The doctoral student is able to formulate a thermodynamic problem in a scientifically correct way                      | E_U01                                 | Responses to questions at lectures. |

|   |  |                 |                                     |
|---|--|-----------------|-------------------------------------|
| EUU2  | The doctoral student is able to formulate general conclusions based on the acquired knowledge in the field of thermodynamics | E_U01           | Responses to questions at lectures. |
| <b>OUTCOMES RELATED TO SOCIAL COMPETENCES</b> |  |                 |                                     |
| EUK1  | The doctoral student knows and understands the impact of energy conversion on the economy and conflicts                      | E_K01,<br>E_K03 | Responses to questions at lectures. |

### Course outline

| No.            | Contents   | Learning outcomes for the course | No. of hours |
|----------------|--|----------------------------------|--------------|
| <b>LECTURE</b> |  |                                  |              |
| W1             | State parameters and functions in thermodynamics   | EUW1, EUW2, EUU1                 | 2            |
| W2             | Transformation of thermal energy into mechanical energy, basic and currently developed ways of transformation  | EUW1, EUW2                       | 2            |
| W3             | Problems of phase transformations and energy cycles  | EUW2, EUU2, EUK1                 | 3            |
| W4             | Counterclockwise compressor and sorption cycles  | EUW2, EUU2, EUK1                 | 2            |
| W5             | Problems of non-equilibrium processes  | EUW2, EUU2                       | 2            |
| W6             | Thermodynamic problems in the dissertations of the doctoral students (each doctoral student prepares a short, assessed presentation, and on this basis, scientific problems are discussed). If there are more doctoral students, the number of hours of this part is extended at the expense of the remaining lectures | EUU1, EUU2, EUW2                 | 4            |

### The ECTS points statement

| WORKING HOURS SETTLEMENT  |   |
|---|---|
| Type of activity  | Average number of hours (45 min.) dedicated to the completion of an activity type |
| <b>SCHEDULED CONTACT HOURS WITH AN ACADEMIC TEACHER</b>                   |   |
| Hours allotted in the syllabus  | 15  |
| Consultations   | 1   |
| Examination / course credit assignment                                    | 0   |
| <b>HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER</b>             |   |
| Independent study of the course contents                                  | 10  |
| Preparation of a paper, a report, a project, a presentation, a discussion | 4   |
| <b>ECTS POINTS STATEMENT</b>  |   |
| Total number of hours   | 30  |
| The ECTS points number  | 1   |

### Preliminary requirements

| No. | Requirements   |
|-----|--|
| 1   | Knowledge of units of measurement and the basic laws of physics. |
|     |  |

### Course credit assignment conditions / method of the final grade calculation

| No. | Description |
|-----|-------------|
|     |             |

|  |  |
|--|--|
| <b>COURSE CREDIT ASSIGNMENT CONDITIONS</b> |  |
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|   |  |
|---|--|
| 1 | Attendance and active participation (with the presentation and involvement in the discussions) at remote lectures recorded in MSTeams. |
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|  |  |
|--|--|
| <b>METHOD OF THE FINAL GRADE CALCULATION</b> |  |
|--|--|

|  |  |
|--|--|
| Course credit assigned on the grounds of the presentation and the involvement in the discussions (at least one contribution to get an E), the number of absences (attendance of at least 50% is required to get an E). |  |
|--|--|

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|-------------------------------|--|
| <b>Additional information</b> |  |
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|                 |  |
|-----------------|--|
| None specified. |  |
|-----------------|--|

|                                |  |
|--------------------------------|--|
| <b>The course reading list</b> |  |
|--------------------------------|--|

|   |   |
|---|---|
| 1 | Styrylska T., <i>Termodynamika</i> , Kraków, 2004, Wydawnictwo Politechniki Krakowskiej.  |
| 2 | Szewczyk W., Wojciechowski J., <i>Wykłady z termodynamiki z przykładami zadań, Część I Procesy termodynamiczne</i> , Kraków, 2007, Wydawnictwa AGH. |
| 3 | Jou D., Casas-Vázquez J., Lebon G.- <i>Extended Irreversible Thermodynamics</i> , Berlin Heidelberg, 1993, Springer-Verlag.                         |