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| | **UNIVERSITY OF EAST SARAJEVO**<br>Faculty of Technology | |
| | ***Study program: Chemical engineering and technology*** | |
| | I STUDY CYCLE \| II STUDY YEAR | |

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|---|---|
| **Course name** | ENGINEERING THREMODYNAMICS |
| **Department** | Department for process engineering-Faculty of Technology |

| **Course code** | **Course status** | **Semester** | **ECTS** |
|---|---|---|---|
| | Obligatory | III | 6 |

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|---|---|
| **Teacher** | PhD Mitar Perusic, full professor |
| **Assistant** | Dusko Kostic, assistant |

| **Hours number (weekly)** | | | **Individual work (hours per semester)** | | | **Student's work coefficient, $S_o$** |
|---|---|---|---|---|---|---|
| **Lectures** | **Class Exercises** | **Laboratory Exercises** | **Lectures** | **Class Exercises** | **Laboratory Exercises** | **$S_o$** |
| 3 | 2 | 0 | 45 | 30 | 0 | 1.4 |

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|---|---|
| Total hours number (hours per semester)<br>3*15 + 2*15 + 0*15 = 75 | Total hours number (hours per semester)<br>3*15*1.40 +2*15*1.40 + 0*15*1.40 = 105 |
| Total hours number (hours per semester, teacher + student): 75+ 105 = 180 | |

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| **Learning outcomes** | 1. To find and use literature data related to energy and thermodynamics of the system;<br>2. To recognize the thermodynamic system, knowledge of the thermodynamic properties of ideal and real gases and vapors;<br>3. Mathematically analyze energy transfer across the boundaries of the thermodynamic system;<br>4. Analyze thermodynamic cycles;<br>5. Analyze, solve, present task solutions and compare results, and recognize the application and importance of thermodynamics in practice. Know the difference between an ideal and a real thermodynamic process. |
| **Conditionality** | No. |
| **Teaching methods** | Lectures, class exercises and individual work |
| **Course content per weeks** | 1. Introduction to the course. Basic concepts of thermodynamics. The concept and forms of energy. Units and dimensions.<br>2. Ideal gas. Ideal gas equation-thermodynamic aspects.<br>3. Working body energy. Internal energy and amount of heat. Thermal capacity.<br>4. The term thermodynamic system. The first principle of thermodynamics, definition and mathematical model.<br>5. The concept of enthalpy. Examples of enthalpy changes in the thermodynamic system in chemical reactions. State changes in the p-v coordinate system.<br>6. The second principle of thermodynamics. Entropy and mathematical model of the second principle of thermodynamics. Examples of the change in entropy of a thermodynamic system in chemical reactions. Colloquium 1.<br>7. Reverse and irreversible processes. Circular processes.<br>8. Thermal T-s diagram and state changes.<br>9. Invert the Carnot cycle.<br>10. Joule return cycle.<br>11. Maximum operation.<br>12. Real gases and vapors. Deviations from the ideal gas equation of state.<br>13. Phase transformations and latent heat. Water and physicochemical properties of water. Water vapor as a working medium.<br>14. Diagrams p-v, T-s and h-s for water vapor.<br>15. Carnot's and Rankin-Clausius cycle for water vapor. Analysis of engineering thermodynamics chapters (seminar paper presentation). Colloquium 2. |

**Obligatory literature**

| **Author/s** | **Name, publisher** | **Year** | **Page** |
|---|---|---|---|
| D. Malic | Thermodynamic and Thermotechnik, GK, Beograd, 7th issue | 1977 | 1-92 |

**Additional literature**

| **Author/s** | **Name, publisher** | **Year** | **Page** |
|---|---|---|---|
| B. Pejovic, M. Perusic | Thermodynamic for engineers-solution manual, Faculty of Technology | 2012 | 1-332 |
| M. Novakovic, M. Djuric | Technical thermodynamic, Faculty of Technology, Novi Sad | 1998 | 1-304 |

| | | | |
|---|---|---|---|
| O. Singh | Applied Thermodynamics, New Age International Limited | 2006 | 1-330 |
| B. Djordjevic, V. Valent, S. Serbanovic | Solution manual, Thermodynamic and Thermmotechnic, TMF, Belgrade | 2004 | 1-223 |

| | Types of evaluation | Points | Percentage |
|---|---|---|---|
| **Obligations, types of knowledge evaluation, final assessment** | Pre-exam obligation | | |
| | Lectures and exercises participation and activity | 6 | 6 % |
| | Seminar work | 14 | 14 % |
| | Colloquium 1 | 25 | 25 % |
| | Colloquium2 | 25 | 25 % |
| | Final exam | | |
| | Final exam (verbal) | 30 | 30 % |
| | TOTAL | 100 | 100 % |
| **Web pages** | www.tfzv.ues.rs.ba | | |
| **Date** | | | |