# DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGIES
# COURSE SYLLABUS

## Course Details

| Code | Academic Year | | | Semester |
|---|---|---|---|---|
| EBT311 | 3 | | | 5 |
| **Title** | **T** | **A** | **L** | **ECTS** |
| Hydrogen Energy and Fuel Cells | 2 | 1 | 0 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Language** | German | | | | | |
| **Level** | **Undergraduate** | **X** | **Graduate** | | **Postgraduate** | |
| **Department / Program** | Energy Science and Technology | | | | | |
| **Forms of Teaching and Learning** | Face-to-face | | | | | |
| **Course Type** | **Compulsory** | | **Elective** | **X** | | |
| **Objectives** | The objective of this course is to provide students with fundamental knowledge about modern hydrogen technologies. The course covers materials science, chemical and physical substance data; hydrogen production through hydrocarbon reforming, hydrogen production from other energy sources; hydrogen storage and purification processes, hydrogen liquefaction, and its technical applications. | | | | | |
| **Content** | This course aims to introduce the use of hydrogen as an energy vector and provide an introduction to hydrogen technologies. The course content includes the fundamentals of fuel cells, different types of fuel cells and their functionality, the classification of combined heat and power (CHP) systems based on fuel cells, their working principles, and application examples. | | | | | |
| **Prerequisites** | None | | | | | |
| **Coordinator** | Assist. Prof. Dr. Meltem KARAİSMAİLOĞLU ELİBOL | | | | | |
| **Lecturer(s)** | Assist. Prof. Dr. Meltem KARAİSMAİLOĞLU ELİBOL | | | | | |
| **Assistant(s)** | | | | | | |
| **Work Placement** | None | | | | | |

## Recommended or Required Reading

| | |
|---|---|
| **Books / Lecture Notes** | Michael F. Hordeski (2009) Hydrogen & Fuel Cells: Advances in Transportation and Power,. The Fairmont Press, Inc. Gupta, R.B. (2009) Hydrogen fuel Production, Transport, and Storage, CRC Press .<br>Sorensen, B., & Spazzafumo, G. (2018). Hydrogen and fuel cells: emerging technologies and applications. ISBN: 9780081007082 |
| **Other Sources** | Michael F. Hordeski (2009) Hydrogen & Fuel Cells: Advances in Transportation and Power,. The Fairmont Press, Inc.<br>Gupta, R.B. (2009) Hydrogen fuel Production, Transport, and Storage, CRC Press . |

## Additional Course Material

| | |
|---|---|
| **Documents** | |
| **Assignments** | |

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|---|---|---|
| **Exams** | | |

## Course Composition

| | | |
|---|---|---|
| **Mathematics and Basic Sciences** | | % |
| **Engineering** | 20 | % |
| **Engineering Design** | 20 | % |
| **Social Sciences** | | % |
| **Educational Sciences** | | % |
| **Natural Sciences** | 20 | % |
| **Health Sciences** | | % |
| **Expert Knowledge** | 40 | % |

## Assessment

| Activity | Count | Percentage (%) |
|---|---|---|
| **Midterm Exam** | 1 | 40 |
| **Quiz** | | |
| **Assignments** | | |
| **Attendance** | | |
| **Recitations** | | |
| **Projects** | | |
| **Final Exam** | 1 | 60 |
| | **Total** | **100** |

## ECTS Points and Work Load

| Activity | Count | Duration | Work Load (Hours) |
|---|---|---|---|
| **Lectures** | 14 | 2 | 28 |
| **Self-Study** | 14 | 9 | 126 |
| **Assignments** | | | |
| **Presentation / Seminar Preparation** | | | |
| **Midterm Exam** | 1 | 2 | 2 |
| **Recitations** | 14 | 1 | 14 |
| **Laboratory** | | | |
| **Projects** | 1 | 8 | 8 |
| **Final Exam** | 1 | 2 | 2 |
| | | **Total Work Load** | **180** |
| | | **ECTS Points** (Total Work Load / Hour) | **6** |

## Learning Outcomes

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|---|---|
| **1** | The importance of alternative energy will be understood. |

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| **2** | Energy conversions and the resulting environmental issues will be learned. |
| **3** | Students will gain knowledge about energy applications in this course. |
| **4** | Students will learn the methods of hydrogen production in this course. |
| **5** | Students will learn the methods of hydrogen storage. |
| **6** | Students will understand how a hydrogen fuel cell works. |
| **7** | Students will be able to perform the necessary calculations for the energy production process of a hydrogen fuel cell. |
| **Weekly Content** | |
| **1** | Conventional and renewable energy sources |
| **2** | Utilization of renewable energy sources such as solar, wind, water, geothermal, and biofuels |
| **3** | Hydrogen energy and its applications |
| **4** | Properties of hydrogen as a fuel |
| **5** | Hydrogen production methods |
| **6** | Hydrogen storage and transportation |
| **7** | Hydrogen storage and transportation |
| **8** | Midterm Exam |
| **9** | Hydrogen technologies |
| **10** | Hydrogen fuel cells 1 |
| **11** | Hydrogen fuel cells 2 |
| **12** | Combination of hydrogen energy with other energy types |
| **13** | Advantages and disadvantages of hydrogen energy |
| **14** | Future of hydrogen energy |
| **15** | Future of hydrogen energy |
| **16** | Final Exam |

| **Contribution of Learning Outcomes to Program Objectives (1-5)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **P7** | **P8** | **P9** |
| **1** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| **2** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| **3** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| **4** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| **5** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| **6** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| **7** | 5 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| Contribution Level 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High | | | | | | | | | |

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|---|---|
| **Compiled by:** | |
| **Date of Compilation:** | |