

| Course Information       |                            |   |   |   |      |             |                            |               |
|--------------------------|----------------------------|---|---|---|------|-------------|----------------------------|---------------|
| Course Code              | T                          | P | L | C | ECTS | Type<br>C/E | Language<br>TR/ENG<br>etc. | Year/Semester |
| FİZ3006                  | 4                          | 2 | 0 | 5 | 5    | C           | TR                         | 3/Spring      |
| Course Name<br>(Turkish) | Atom ve Molekül Fiziği     |   |   |   |      |             |                            |               |
| Course Name<br>(English) | Atom and Molecules Physics |   |   |   |      |             |                            |               |

| Unit/Program                                                      | Physics Department/Undergraduate Program                                                                                                                                                                                                                                                                                        |             |               |      |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------|------|
| Course Prerequisite                                               | No                                                                                                                                                                                                                                                                                                                              |             |               |      |
| Course Objectives                                                 | To study the structure of atoms and molecules, their interactions with each other and their dynamics. In addition, to explain the macroscopic properties of matter on the basis of atoms, which are microscopic components of matter, and to define the relationships between macroscopic and microscopic properties of matter. |             |               |      |
| Course Outline                                                    | Orbital and spin motions in one-electron atoms, Multi-electron atoms and atomic spectroscopy, Molecular Structure, Electronics, Vibration and Rotational Motions of Molecules, Molecular spectroscopy                                                                                                                           |             |               |      |
| Textbook/ Material / Resources                                    | 1.Atomic and Molecular Physics: Translation: Fevzi KÖKSAL and Hasan GÜMÜŞ<br>2.Concepts of Modern Physics: Translation: Gülsen ÖNENGÜT                                                                                                                                                                                          |             |               |      |
| Internship Status                                                 | No                                                                                                                                                                                                                                                                                                                              |             |               |      |
| Course Precedents                                                 |                                                                                                                                                                                                                                                                                                                                 |             |               |      |
| University Name                                                   | Program Name                                                                                                                                                                                                                                                                                                                    | Course Name | T-U-L-K; AKTS | Type |
|                                                                   |                                                                                                                                                                                                                                                                                                                                 |             |               |      |
|                                                                   |                                                                                                                                                                                                                                                                                                                                 |             |               |      |
|                                                                   |                                                                                                                                                                                                                                                                                                                                 |             |               |      |
| The instructor who proposed the course ( Title, Name and Surname) |                                                                                                                                                                                                                                                                                                                                 |             | Signature     |      |
|                                                                   |                                                                                                                                                                                                                                                                                                                                 |             |               |      |
| Instructors who can teach the course (Title, Name and Surname)    |                                                                                                                                                                                                                                                                                                                                 |             | Signature     |      |
|                                                                   |                                                                                                                                                                                                                                                                                                                                 |             |               |      |
|                                                                   |                                                                                                                                                                                                                                                                                                                                 |             |               |      |

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|-----------------------------------------------------------------------------------------------------------------|
| Academic justification for the opening of the course? (The effect of course outcomes on program outcomes, etc.) |
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| Brief explanation of the course (theoretical lecture, applications, laboratory, studio, off-campus activity, using software, etc.) |
| The lesson with the students will be taught face-to-face on the board.                                                             |

|                                                                                                                                                                                                                                                                                                                                 |                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| External Stakeholder Opinions About the Course (It is expected that the opinions to be obtained from the business world that will employ your graduates or from real or legal persons outside the University who have expertise on the subject of the course will be specified. Proof documents must be attached to this form.) |                                                                            |
| Stakeholder Name                                                                                                                                                                                                                                                                                                                | Opinion (It should be given as a summary, it should not exceed two lines.) |
|                                                                                                                                                                                                                                                                                                                                 |                                                                            |
|                                                                                                                                                                                                                                                                                                                                 |                                                                            |

| Weekly Course Content Distribution |                                                                            |                        |
|------------------------------------|----------------------------------------------------------------------------|------------------------|
| Week                               | Theory                                                                     | Application/Laboratory |
| 1                                  | Atom Modelleri, Bohr Atom Models                                           |                        |
| 2                                  | Quantum Theory of Atoms with One Electron, Orbital Motion                  |                        |
| 3                                  | Quantum Theory of Atoms with One Electron, Spin Motion of Electron         |                        |
| 4                                  | Thin and Extremely Thin Structures                                         |                        |
| 5                                  | Zeeman and Stark Incidents                                                 |                        |
| 6                                  | Possibility of passage and Selection Rules                                 |                        |
| 7                                  | Spectroscopic Notations and Term symbols                                   |                        |
| 8                                  | Multi-electron Atoms, Independent Particle Model and Variation Principle   |                        |
| 9                                  | Midterm Exam                                                               |                        |
| 10                                 | Pauli's principle, Hund's Rules, and term symbols for multi-electron atoms |                        |
| 11                                 | Molecular Structure and Types of Molecular Bonds                           |                        |
| 12                                 | Electronic Schrödinger Equation and Molecular Orbitals                     |                        |
| 13                                 | Vibrational Motions of Molecular and Vibrational Spectroscopy              |                        |
| 14                                 | Rotational Motions of Molecules and Rotational Spectroscopy                |                        |
| 15                                 | Finale                                                                     |                        |
| 16                                 |                                                                            |                        |

| Assessment          |               |        |                                   |
|---------------------|---------------|--------|-----------------------------------|
| Evaluation Criteria | Activity      | Custom | Contribution to Success Grade (%) |
|                     | Midterm Exams | 1      | %40                               |
|                     | Quizzes       |        |                                   |
|                     | Assignments   |        |                                   |
|                     | Projects      |        |                                   |
|                     | Term Paper    |        |                                   |
|                     | Laboratory    |        |                                   |
|                     | Other         |        |                                   |
|                     | Final Exam    | 1      | %60                               |
|                     | Sum:          |        | 100                               |
| Remarks             |               |        |                                   |

| Content Design and Subject Weight (%) | Mathematics and Basic Sciences | %100 |
|---------------------------------------|--------------------------------|------|
|                                       | Engineering Sciences           |      |
|                                       | Social Sciences                |      |
|                                       | Health Sciences                |      |
|                                       | Educational Sciences           |      |
|                                       | Culture and Art Sciences       |      |
|                                       | Design Information             |      |

| Workload (ECTS) Calculation                                                                                                          |        |                  |                        |
|--------------------------------------------------------------------------------------------------------------------------------------|--------|------------------|------------------------|
| Events                                                                                                                               | Number | Duration (Hours) | Total workload (Hours) |
| Fieldwork                                                                                                                            |        |                  |                        |
| Midterm Exam Application                                                                                                             | 1      | 2                | 2                      |
| Self-Study (including pre-class and exam preparation)                                                                                |        |                  |                        |
| Make-up Exam                                                                                                                         | 1      | 2                | 2                      |
| Experiment and Observation                                                                                                           |        |                  |                        |
| Class Participation (Theory)                                                                                                         | 14     | 6                | 84                     |
| Homework                                                                                                                             |        |                  |                        |
| Final Exam Practice                                                                                                                  | 1      | 2                | 2                      |
| Laboratory                                                                                                                           |        |                  |                        |
| Article Review                                                                                                                       |        |                  |                        |
| Writing an Article                                                                                                                   |        |                  |                        |
| Reading                                                                                                                              |        |                  |                        |
| Case Study                                                                                                                           |        |                  |                        |
| Performance                                                                                                                          |        |                  |                        |
| Problem Solution                                                                                                                     | 14     | 2                | 28                     |
| Project Preparation                                                                                                                  |        |                  |                        |
| Project Submission                                                                                                                   |        |                  |                        |
| Quiz                                                                                                                                 |        |                  |                        |
| Report Preparation                                                                                                                   |        |                  |                        |
| Submitting Reports                                                                                                                   |        |                  |                        |
| Role/Drama Work                                                                                                                      |        |                  |                        |
| Seminar                                                                                                                              |        |                  |                        |
| Oral Exam                                                                                                                            |        |                  |                        |
| Team/Group Work                                                                                                                      |        |                  |                        |
| Argument                                                                                                                             |        |                  |                        |
| Application/Practice                                                                                                                 | 7      | 1                | 7                      |
| Other                                                                                                                                |        |                  |                        |
| TOTAL WORKLOAD:                                                                                                                      |        |                  | 125                    |
| ECTS CREDITS OF THE COURSE:<br>(The number obtained as a result of Total Workload/25 is calculated by rounding to the whole number.) |        |                  | 5                      |

| The Relationship Between Course Learning Outcomes and Program Outcomes |                                                                                                           |                       |   |   |   |   |   |   |   |   |    |    |    |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------|---|---|---|---|---|---|---|---|----|----|----|
|                                                                        |                                                                                                           | Program Outcomes (PO) |   |   |   |   |   |   |   |   |    |    |    |
|                                                                        |                                                                                                           | 1                     | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Learning Outcomes (LO) (Course Outcomes)                               |                                                                                                           |                       |   |   |   |   |   |   |   |   |    |    |    |
| 1                                                                      | To be able to explain the microscopic structure of substances consisting of different atoms and molecules | 5                     | 5 | 5 | 3 | 3 | 1 | 5 | 4 | 5 | 1  | 1  |    |
| 2                                                                      | To be able to distinguish and define the difference between classical and quantum physics                 | 5                     | 5 | 5 | 3 | 3 | 1 | 5 | 4 | 5 | 1  | 1  |    |
| 3                                                                      | To be able to explain the basic structures of hydrogen and helium atoms using Quantum Physics theories    | 5                     | 5 | 5 | 3 | 3 | 1 | 5 | 4 | 5 | 1  | 1  |    |

**Organizer:** Assoc. Prof. Dr. Seda HEKİM

**Preparation Date:** 20.05.2024