**Sule Lamido University, Kafin Hausa**
**Faculty of Natural and Applied Sciences**
**Department of Physics**
**2019/2020 Second Semester**

**Course Title:** Atomic and Molecular Spectroscopy **Course Code:** PHY 436 **Credit Unit:** 3

**Course Staff:**

**Lecturer:** Associate Prof. Abdussalam Balarabe Suleiman

**Room Number: A5**

**Laboratory Instructor:** Mal.

**Course Prerequisites:** PHY335

**Lecture Period:** Thursday, 02:00 pm – 04:00 pm

**Lecture Venue:** Lecture Room 4

**Reference Texts:**


1. **Atomic and Molecular Spectroscopy: Basic concept and Applications,** 2015, Cambridge University Press, ISBN: 9781107479999, by ***Rita Kakkar.***
2. **Fundamentals of molecular spectroscopy,** 4th ed, Tata McGraw Hill-Pub, 1993, by ***Colin Neville Banwell***.
3. **Molecular Spectroscopy,** 2nd ed, CRC Press Taylor and Francis Group, 1999, by ***Jean L. McHale***
4. **Atomic and Molecular Spectroscopy: Basic application and Practical applications,** 4th ed, Spinger, 2004, ISBN: 3-540-20382-6, by ***Sune Svanberg***
5. **Basic atomic and molecular spectroscopy,** Royal Society of Chemistry, 2002, by ***J. Michael Hollas.***
6. **introdu**


**Lecture Notes:** Lecture guides will be given to the class representative at least a day before each lecture.

**Course Objectives:**
The objectives of the course are as follows:

1. To describe the behavior and basic concept of the hydrogen atom: relativistic effects and spin.
2. To discuss the basic concept of coupling schemes and vector model, Seeman effect and Hyperfine structure.
3. To determine the diatomic molecule: the frank-Cordon principle.

4. To comprehensively explain the basic concept of X-ray diffraction and microwave methods.
5. To define and discuss resonance phenomena: ESR, NMR, and optical pumping and Mossbauer scattering.

**Measurement of Course Outcome:**

At the end of the course lectures, a student will be able to:

1. Understand and explain what atomic and molecular spectroscopy is all about.
2. Explain basic and practical application of atomic and molecular spectroscopy.
3. Have a clear and precise understanding of hydrogen atom, coupling schemes and vector model.
4. Define and explain the basic concept of Seeman effect, hyperfine structure and the frank-Cordon principle.

**Course Grading:**

1. Assignment / Project:**10%**
2. Continuous Assessment Tests: **30%**
3. Final Examination: **60%**

**General Information:**

1. Students must attend a minimum of 75% of the total lecture hours in order to be eligible to write the final exam. Students should notify the course staff of any intended absence from a lecture or laboratory at least a day prior to such lecture or laboratory. In a situation where the student is ill, an official documentation should be obtained from the university clinic.
2. The continuous assessment tests will be conducted in the weeks five and ten of the semester; thereafter, lecture commence for the week.
3. The final examination timetable will be as scheduled by the Faculty. Students are expected to liaise with the Sub-dean of the faculty to make sure that there are no clashes on their examination schedule.
4. Students are encouraged to meet with course staff to sort out any administrative and academic issues they may have relating to the course.
5. Students will be expected to fill out an online course assessment form, midway through the semester to get a feedback of what their lecture and laboratory experiences have been.
6. Students are encouraged to collaborate on assignments but every student must do the assignment on their own. It is important for student to note that cheating or any kind of academic dishonesty will not be tolerated and will be met with harsh punishment by the university administration if discovered (Please refer to student handbook).

## Lecture Schedule

| Lect. No. | Date | Topic |
|---|---|---|
| 1 | Week 1 | Course Administration and general review of the course |
| 2 | Week 2 | The hydrogen atom: relativistic effects and spin. |
| 3 | Week 3 | Identical particles & symmetry, and many electron atoms. |
| 4 | Week 4 | Coupling schemes and vector model. |
| 5 | Week 5 | **(Test 1)** Seeman effect |
| 6 | Week 6 | Seeman effect and Hyperfine structure. |
| 7 | Week 7 | The diatomic molecule: the frank-Cordon principle. |
| 8 | Week 8 | X-ray diffraction and microwave methods. |
| 9 | Week 9 | Resonance phenomena: ESR, NMR, |
| 10 | Week 10 | **(Test 2)** |
| 11 | Week 11 | Resonance phenomena: optical pumping and Mossbauer scattering. |
| 12 | Week 12 | Laboratory demonstration |
| 13 | Week 13 | General Course Revision |