****

**Department of General Science**

**College of Basic Education**

**Salahaddin University-Erbil**

**Subject: Modern Physics**

**Course Book – *Fourth Year***

**Lecturer: Dr. Mohammed Azeez Saeed**

**Academic Year: 2022/2023**

**Updated on January 5th , 2023**

**Course Book**

|  |  |  |
| --- | --- | --- |
| **1. Course name** | **Modern Physics** | |
| **2. Lecturer in charge** | **Mohammed Azeez Saeed** | |
| **3. Department/ College** | **General Science/Basic Education** | |
| **4. Contact** | **e-mail:** [**mohammed.aziz@su.edu.krd**](mailto:mohammed.aziz@su.edu.krd)  **Tel: 0750 462 2954** | |
| **5. Time (in hours) per week** | **Theory: 2 hours /week**  **Practical: X** | |
| **6. Office hours** | **Sunday and Thursday** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | **B.Sc. in Physics - Sulaimani University,1977**  **M.Sc. Meteorology and Climatology- Birmingham University ,1980.**  **Ph. D.Astronomy - Baghdad University, 2001.**  **Teaching and research in the fields Meteorology, Climate , Differential Equations, Modern Physics,Heat and thermodynamics, Mathematical Physics , Solar Radiation and Astronomy for over 30 years. Supervising both M.Sc. and Ph.D. students. Participating in the oral examinations of postgraduate students in most of the universities of Kurdistan Region.** | |
| **9. Keywords** |  | |
| * Physics the science of the study of energy and matter and their interaction between them. It has been divided into two branches: * Classical physics: That branch of physics which concern with physics before 20th century ( before 1897) * Modern Physics is the branch of physics which began from the beginning of the 20th century (1897) onwards. * Modern physics started with the structure of the atom, wave properties of the particles. | | |
| **11. Course objective:**   1. Classical Physics, Review 2. Relativity, experimental basics of relativity, Michelson-Morley experiment, Einstein Postulates, Lorentz transformation, Doppler effect, relativistic momentum & energy, mass/energy conversion & binding energy. General relativity 3. Quantization of charge, light & energy, Blackbody radiation, photoelectric effect, X rays & the Compton Effect. 4. The nuclear atom, atomic spectra, Rutherford model, Bohr model of the hydrogen atom, X-ray spectra, 5. Wave like properties of the particles, de-Broglie hypothesis, measurement of particle wavelengths, Heisenberg uncertainty principle, wave particle duality. 6. The Schrodinger Equation, Schrodinger equation in one dimension, infinite square well, Finite Square well, transitions between energy states. 7. Atomic physics, Schrodinger equation in three dimensions, quantization of angular momentum & energy in the hydrogen atom, hydrogen atom wave functions, electron spin. 8. Statistical physics, classical statistical physics, quantum statistics, Bose-Einstein. Liquid helium, photon gas & Fermion gas. | | |
| **12. Student's obligation**  The students shall participate in discussion of the topics and solving practical examples related to the subjects. The exercises will be given to the students as home works. The students will also be asked to prepare reports on selected topics.  لێره‌ مامۆستا به‌رپرسیارێتی قوتابی خوێندکار ڕوونده‌کاته‌وه‌ سه‌باره‌ت به‌ کۆرسه‌که‌ بۆ نموونه‌ ئاماده‌بوونی قوتابیان له‌ وانه‌کاندا، له‌ تاقیکردنه‌وه‌کاندا، راپۆرت و ووتار نووسین... هتد. | | |
| **13. Forms of teaching**  Data Show power point presentation and the white board. | | |
| **14. Assessment scheme**  Breakdown of overall assessment and examination  Semesters examination (two examinations in a year, each 20%). | | |
| **15. Student learning outcome:**  This subject is concerned with the basic science of Modern Physics for undergraduate students. Classical physics will be reviewed. Relativity, atomic structure of the particles and dual particle-wave properties will be learned. | | |
| **16. Course Reading List and References‌:**  **References:**   * 1. Introduction to Modern Physics.Charles W.Fay.2011.   2. Concept of Modern Physics. Sixths edition, Arthur Beiser,2003.   3. Introduction to modern physics, Volume I.R.B.Singh, second edition, 2009.   4. Modern Physics for Science & Engineering.M.L.Burns.2012.   5. Modern Physics.Third edition, R.A.Serway, et.al. 2005.   6. Modern Physics.P.A.Tipler.2008   7. <http://ocw.tufts.edu/Course/36/Coursehome>   8. <http://galileo.phys.virginia.edu/classes/252/home.html> | | |
| **17. The Topics:** | | **Lecturer's name** |
| **Chapter 1.** The birth of Modern Physics   1. What is physics   1.1 Classical Physics & Modern Physics  1.2 Classical mechanics  1.3 Classical Electro-Magnetism  1.4 Maxwell  1.5 Maxwell equations  1.6 Speed of light  1.7 EM & Optics  1.8 Exercises  **Chapter 2.** Relativity   1. Special relativity   2.1 two postulates  2.2 Measurement of length  2.3 Length contraction  2.4 Time dilation  2.5 Doppler Effect  2.6 Twin Paradox  2.7 velocity Transformation  2.8 general relativity  2.9.1. Two principle of general relativity  2.9.2 Black holes  2.9.3 Exercises  **Chapter 3.** The Atom  3.0 The electron  3.1 Thomson discovery of electron  3.2 Fundamental charge, Millikan  3.3 Rutherford Model  3.4 Bohr Model  3.5 Bohr Radius  3.6 Energy of Bohr atom  3.7 Exercises  **Chapter 4.** Origin of Quantum Mechanics  4.1 Quantum Hypothesis  4.1 Einstein & the photoelectric effect  4.2 The photoelectric effect   * 1. Compton Scattering   4.4 de-Broglie  4.5 de-Broglie wavelength  4.6 Wave-particle duality  4.7 Heisenberg Uncertainty principle  **Chapter 5.** Quantization of one electron model  5.1 Introduction  5.2 Atomic spectra  5.3 Reidberg  5.4 Lyman  5.5 Balmer  5.6 Paschen  5.7 Brackett  5.8 Pfund  **Chapter 6.** Quantum Theory  6.1 Schrodinger’s equation  6.2 Time dependent Schrodinger Equation  6.3 Time independent Schrodinger Equation  6.4 Wave function  6.5 Eigen value & eigen function  6.6 particle in a box  **Chapter 7.** Nuclear Structure   1. Nucleus   7.1 Charge and mass  7.2 Size & structure  7.3 Nuclear stability  7.4 The volume and density  7.5 Binding Energy  7.6 Nuclear Forces  **Chapter 8** Radiation  8.0 Radioactivity  8.1 Alpha decay  8.2 Beta decay  8.3 Gamma decay  8.4 Half life  8.5 binding energy  8.6 Nuclear fission  8.7 Nuclear fusion  8.8 Exercises  **Chapter 9** The standard model  9.0 Beta decay & neutrino  9.1 Fundamental forces  9.2 Electro-magnetic force & photons  9.3 Strong force & mesons  9.4 Weak force & W particle  9.5 Gravity & Graviton  9.6 Fundamental particle  9.7 Examples | | Mohammed Azeez Saeed |
| **18. Practical Topics (If there is any)** | |  |
| No Practice and Experiments. It is a theoretical subject. | |  |
| **19. Examinations:**  ***1. Compositional:*** In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?  With their typical answers  Examples should be provided  ***2.******True or false type of exams:***In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. Examples should be provided  ***3. Multiple choices:***In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. Examples should be provided. | | |
| **20. Extra notes:**  Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. | | |