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**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**

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| **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****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.
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| **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.
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| **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 examinationSemesters 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>
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| **17. The Topics:** | **Lecturer's name** |
| **Chapter 1.** The birth of Modern Physics1. What is physics

1.1 Classical Physics & Modern Physics1.2 Classical mechanics1.3 Classical Electro-Magnetism 1.4 Maxwell1.5 Maxwell equations1.6 Speed of light1.7 EM & Optics1.8 Exercises**Chapter 2.** Relativity1. Special relativity

2.1 two postulates2.2 Measurement of length2.3 Length contraction2.4 Time dilation2.5 Doppler Effect2.6 Twin Paradox2.7 velocity Transformation2.8 general relativity2.9.1. Two principle of general relativity2.9.2 Black holes2.9.3 Exercises **Chapter 3.** The Atom3.0 The electron3.1 Thomson discovery of electron3.2 Fundamental charge, Millikan3.3 Rutherford Model3.4 Bohr Model3.5 Bohr Radius3.6 Energy of Bohr atom3.7 Exercises**Chapter 4.** Origin of Quantum Mechanics4.1 Quantum Hypothesis4.1 Einstein & the photoelectric effect4.2 The photoelectric effect* 1. Compton Scattering

4.4 de-Broglie4.5 de-Broglie wavelength4.6 Wave-particle duality4.7 Heisenberg Uncertainty principle**Chapter 5.** Quantization of one electron model5.1 Introduction5.2 Atomic spectra5.3 Reidberg5.4 Lyman5.5 Balmer5.6 Paschen5.7 Brackett5.8 Pfund**Chapter 6.** Quantum Theory6.1 Schrodinger’s equation6.2 Time dependent Schrodinger Equation6.3 Time independent Schrodinger Equation6.4 Wave function6.5 Eigen value & eigen function6.6 particle in a box**Chapter 7.** Nuclear Structure1. Nucleus

7.1 Charge and mass7.2 Size & structure7.3 Nuclear stability7.4 The volume and density7.5 Binding Energy7.6 Nuclear Forces **Chapter 8** Radiation8.0 Radioactivity8.1 Alpha decay8.2 Beta decay8.3 Gamma decay8.4 Half life8.5 binding energy8.6 Nuclear fission8.7 Nuclear fusion8.8 Exercises**Chapter 9** The standard model9.0 Beta decay & neutrino9.1 Fundamental forces9.2 Electro-magnetic force & photons9.3 Strong force & mesons9.4 Weak force & W particle9.5 Gravity & Graviton9.6 Fundamental particle9.7 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 answersExamples 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. |