**University of Management and Technology**

**School of Science**

**Department of Physics**

**Course Code: PH-204**

**Course Title: MODERN PHYSICS**

**Program: BS (Phy., Math., Chem)**

**Course Outline (Spring 2021)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Schedule** | Monday ----Thursday | **Pre-requisite** | Mechanics, Electricity and Magnetism | |
| **Resource Person** | Hira Yaseen | **Contact** | hira.yaseen@umt.edu.pk | |
| **Course**  **Description** | Motivation for Non--Classical Physics, Wace-Particle Duality, Special Theory of Relativity, Quantum Mechanics in One Dimension, Quantum Mechanical Tunneling, Quantum Mechanics in Three Dimensions, From Atoms to Molecules and Solids, Nuclear Structure. | | | |
| **Expected**  **Outcomes** | Students will be able to understand the non-classical aspects of Physics; the emphasis will be on the applications of Quantum Physics in microscopic-scale Physics, atomic and molecular structure and processes. | | | |
| **Text Book**  **Ref. Book** | 1. R.A. Serway, C.J. Moses and C.A. Moyer, “Modern Physics”, Brooks Cole, 3rd ed. 2004.  2. Arthur Beiser, “Concepts of Modern Physics”, McGraw-Hill, 6th ed. 2002.  3. Paul A. Tipler and Ralph A. Llewellyn, “Modern Physics”, W H Freeman and Company 6th ed. 2012.  R. M. Eisberg and R. Resnick, “Quantum Physics of Atoms, molecules, Solids, Nuclei and Particles”, John Wiley, 2nd ed. 2002. | | | |
| **Assignment& Projects** | Problems will be assigned at regular intervals as an assignment. | **Quizzes** | | All quizzes will be announced well before time.  No make-ups will be offered for missed quizzes. |
| **Mid - Term**  **Examination** | A 60-minutes exam will cover all the material covered during the first 15 lectures | **Final**  **Examination** | | A 120-minutes exam will cover all the material covered during the semester. |
| **Attendance**  **Policy** | Students missing more than 20% of the lectures will receive an “SA” grade in the course and will not be allowed to take final exam. | | | |

Modern Physics

**Lecture Plan (Spring 2021)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Lecture**  **#** | **TOPICS** | **Book** |
| 1 | 1  2 | Blackbody radiation and ultraviolet catastrophe  Planck's quantization | Serway, Beiser |
| 2 | 1  2 | Photoelectric effect  Compton effect | Serway, Beiser |
| 3 | 1  2 | Special Theory of Relativity (Continue)  Special Theory of Relativity | Serway, Beiser |
| 4 | 1  2 | Concept of matter waves  De Broglie relationship | Serway, Beiser |
| 5 | 1  2 | Electron diffraction  Particulate nature of matter | Serway, Beiser |
| 6 | 1  2 | Rutherford (nucleus exists) and Bohr (quantization of energies inside an atom)  Wave packets and wave groups | Serway, Beiser |
| 7 | 1  2 | Dispersion  Heisenberg uncertainty principle | Serway, Beiser |
| 8 | 1  2 | Direct confirmation of quantization through Franck-Hertz experiment and spectroscopy  Working of electron microscopes. | Serway, Beiser |
| 9 | 1  2 | The concept of a wave function, time independent Schrodinger equation and interpretation of the equation  Solving the Schrodinger equation for a free particle, for a particle inside an infinite box | Serway, Beiser |
| 10 | 1  2 | Concept of tunneling  Reflection and transmission of wave functions from barriers | Serway, Beiser |
| 11 | 1  2 | Radioactivity  The Hydrogen atom | Serway, Beiser |
| 12 | 1  2 | Orbitals  Angular momentum and its quantization | Serway, Beiser |
| 13 | 1  2 | Zeeman effect  Concept of spin | Serway, Beiser |
| 14 | 1  2 | Pauli’s exclusion principle  Magnetic resonance and MRI | Serway, Beiser |
| 15 | 1  2 | Bands in solids, Semiconductors  Radioactivity and nuclear reactions, Radiocarbon dating | Serway, Beiser |