**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)**

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| **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)**

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| **Week** | **Lecture****#** | **TOPICS** | **Book** |
| 1 | 12 | Blackbody radiation and ultraviolet catastrophePlanck's quantization | Serway, Beiser |
| 2 | 12 | Photoelectric effectCompton effect | Serway, Beiser |
| 3 | 12 | Special Theory of Relativity (Continue)Special Theory of Relativity | Serway, Beiser |
| 4 | 12 | Concept of matter wavesDe Broglie relationship | Serway, Beiser |
| 5 | 12 | Electron diffractionParticulate nature of matter | Serway, Beiser |
| 6 | 12 | Rutherford (nucleus exists) and Bohr (quantization of energies inside an atom)Wave packets and wave groups | Serway, Beiser |
| 7 | 12 | DispersionHeisenberg uncertainty principle | Serway, Beiser |
| 8 | 12 | Direct confirmation of quantization through Franck-Hertz experiment and spectroscopyWorking of electron microscopes. | Serway, Beiser |
| 9 | 12 | The concept of a wave function, time independent Schrodinger equation and interpretation of the equationSolving the Schrodinger equation for a free particle, for a particle inside an infinite box | Serway, Beiser |
| 10 | 12 | Concept of tunnelingReflection and transmission of wave functions from barriers | Serway, Beiser |
| 11 | 12 | RadioactivityThe Hydrogen atom | Serway, Beiser |
| 12 | 12 | OrbitalsAngular momentum and its quantization | Serway, Beiser |
| 13 | 12 | Zeeman effectConcept of spin | Serway, Beiser |
| 14 | 12 | Pauli’s exclusion principleMagnetic resonance and MRI | Serway, Beiser |
| 15 | 12 | Bands in solids, SemiconductorsRadioactivity and nuclear reactions, Radiocarbon dating | Serway, Beiser |