**University of Management and Technology**

**School of Science and Technology**

***Department of Physics***

**Course Code:** **PH 6011**

**Course Title: Advanced Statistical Physics**

**Program: MS (Phy)**

**Course Outline**

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| **Schedule** | Wednesday and Sunday | **Pre-requisite** | Thermal Physics | |
| **Course Coordinator** | Dr. Tanvir Hussain | **Contact** | tanvir.hussain@umt.edu.pk | |
| **Text**  **Book** | \* Statistical Physics by Franz Mandl Second Edition  \*\* The Introduction of Thermal Physics by Daniel V. Schroeder | | | |
| **Reference Book:** | W. Brewer, F. Schwabl, “Statistical Mechanics”, Springer, 2nd ed. 2006. . | | | |
| **Assignments** | 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 120-minutes exam will cover all the material covered during the first  7-8 lectures.  Combined Mid Term exam for all multiple sections. | **Final**  **Examination** | | A 180-minutes exam will cover all the material covered during the semester.  Combined Final exam for all multiple sections |
| **Attendance**  **Policy** | Students missing more than 25% of the lectures will receive an “SA” grade in the course and will not be allowed to take Final exam. | | | |
| **Grading**  **Policy** | Assignment+ Quizzes  (Minimum number of assessments will be 8): 30%  Mid Term Examination: 30%  Final Examination: 40% | | | |

**Department of Physics**

**Statistical Physics (PH 310)**

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| **Week** | **Lecture**  **#** | **TOPICS** |
| 1 | 1 | The first Law of thermodynamics |
| 2 | 1 | Second Law of thermodynamics  Direction of the natural process  The statistical Weight of a Microstate |
| 3 | 1 | The equilibrium of an isolated system  The Schottky Defects  Equilibrium of a system in heat Bath |
| 4 | 1 | Paramagnetism  A magnetic Solid in Heat Bath  An Isolated Paramagnetic Solid  Negative Temperature |
| 5 | 1 | The Second Law of Thermodynamics II  The Clausius Inequality |
| 6 | 1 | The Helmholtz Free Energy  Third Law of thermodynamics |
| 7 | 1 | The Heat capacity of Solids  Einstein’s Solids  Debye’s Theory |
| 8 | 1 | The perfect Classical Gas  The partition Function |
| 9 | 1 | The Maxwell Velocity Distribution  The heat Capacity |
| 10 | 1 | Phase Equilibria  The Clausius - Clapeyron Equation |
| 11 | 1 | The perfect Quantal Gas  Grand partition function |
| 12 | 1 | Quantum Statistics: The partition function for photons  Quantum Statistics: Plank’s Law: Derivation |
| 13 | 1 | The thermodynamics of black body radiation  System with variable particle numbers |
| 14 | 1 | Quantum Statistics : Fermi Dirac distribution  Quantum Statistics : Fermi Dirac distribution |
| 15 | 1 | Quantum Statistics : The free electron Model of metals  Quantum Statistics : Bose –Einstein condensation |