** University of Management and Technology**

**School of Science and Technology**

**Department of Physics**

**Course Code** **PH-103/ PH-107**

**Course Title: Waves and Oscillations/ Waves, Oscillations and Optics**

**Program: BS (PH/MA)**

**Course Outline (Spring Semester 2023)**

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| --- | --- | --- | --- | --- | --- |
| **Schedule** | Monday----Thursday | **Pre-requisite** | | --------------- | |
| **Course Coordinator** | Ms. Sidra Ashraf | **Contact** | | Sidra.ashraf@umt.edu.pk | |
| **Course**  **Description** | Waves and vibrations are present in almost all physical systems, from the vibrations in strings to the waves of the oceans and atmosphere. Waves and patterns are also seen in chemical and living systems. This course is an introduction to the theory of waves; starting from description of the state of mater this course will explain the fluids, elasticity & oscillations in solids, simple harmonic motion, waves and types of waves, sound waves and elementary ideas about sound waves like timber, beats, Doppler effect, echolocation and medical imaging. In addition to the above mentioned standard topics the second part of this course is based on thermal physics and it covers the topics like temperature and the ideal gas laws, thermal expansion of solids and liquids, heat, internal energy, thermal conduction, convection & radiation and finally thermodynamics. The material is illustrated with applications from a wide variety of different systems.  The learning in this course is strengthened by related lab work. | | | | |
| **Expected**  **Outcomes** | The Participants will learn unified mathematical theory of oscillations and waves in physical systems. They will also be ready for advance courses like modern physics.  . | | | | |
| **Text**  **Book** | Physics for Scientists and Engineers, Jewett/Serway, 7thEdition, 2011. | | | | |
| **Assignment & Projects** | Problems will be assigned at regular intervals as an assignment.  Marks will be deducted for late submission. | | **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 14-16 lectures.  Combined Mid Term exam for all multiple sections. | | **Final**  **Examination** | | A 120-minutes exam will cover all the material covered during the semester.  Combined Final exam for all multiple sections. |
| **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. | | | | |
| **Grading**  **Policy** | Assignment + Quizzes: 30%  Mid Term Examination: 30%  Final Examination: 40% | | | | |

Waves and Oscillations

**Lecture Plan (Spring 2023)**

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| **Week** | **Lecture**  **#** | **TOPICS** | **CH** | **SECTIONS** |
| 1 | 1  2 | Newton’s law of gravitation, Free fall acceleration  Kepler’s laws, Gravitational field | 13  13 | 1 – 2  3 – 4 |
| 2 | 1  2 | Gravitational potential energy, Energy conservations  Pressure, Pressure with depth, Buoyant forces | 13  14 | 5 - 6  1 – 4 |
| 3 | 1  2 | Fluid dynamics, Bernoulli’s equation and application  Spring, Simple Harmonic Motion, | 14  15 | 5 – 7  1 – 2 |
| 4 | 1  2 | Energy of SHM, SHM and circular motion  The pendulum, damped and forced oscillations | 15  15 | 3 – 4  5 – 7 |
| 5 | 1  2 | Propagation of waves, Travelling waves, Speed of waves  Reflection and transmission, Energy transfer, Linear wave | 16  16 | 1 – 3  4– 6 |
| 6 | 1  2 | Sound waves, Speed and intensity of sound waves  Doppler’s effect, Sound recording, Motion picture sound | 17  17 | 1 – 3  4 – 6 |
| 7 | 1  2 | Superposition and Interference  Standing waves in a string and column, Resonance | 18  18 | 1  2 – 6 |
| 8 | 1  2 | Beats, Nonsinusoidal waves  Zeroth law of thermodynamics, Thermometer | 18  19 | 7 – 8  1 – 2 |
| 9 | 1  2 | Absolute temperature, Thermal expansion, Ideal Gas  Heat and Internal energy, Specific heat | 19  20 | 3 - 5  1 - 2 |
| 10 | 1  2 | Latent heat, work-heat in thermodynamics  First law of thermodynamics, energy transfer mechanism | 20  20 | 3 – 4  5 – 7 |
| 11 | 1  2 | Molecular model of gas, Molar specific heat  Adiabatic process, equipartition of energy, molecular speed | 21  21 | 1 – 2  3 – 5 |
| 12 | 1  2 | Second law of thermodynamics, Refrigerators  Reversible processes, Carnot and diesel engines | 22  22 | 1 – 2  3 – 5 |
| 13 | 1  2 | Entropy  Ampere’s law, Maxwell equations | 22  34 | 6 – 8  1 – 2 |
| 14 | 1  2 | Electromagnetic waves, Energy carried by EM waves  Momentum and radiation Pressure | 34  34 | 3 – 4  5 |
| 15 | 1  2 | Production of EM waves, Spectrum of EM waves  Revision | 34 | 6 – 7 |