** University of Management and Technology**

**School of Science**

**Department of Physics**

**Course Code** **PH-206**

**Course Title: OPTICS**

**Program: BS (PH)**

**Course Outline (Spring Semester 2023)**

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| --- | --- | --- | --- | --- |
| **Schedule** | Monday----Saturday | **Pre-requisite** | Nil | |
| **Course Coordinator** | Dr. Sidra Khalid | **Contact** | sidra.khalid@umt.edu.pk | |
| **Course**  **Description** | Particles and Photons, The Electromagnetic Spectrum, Radiometry, Huygens’ and Fermat’s Principle, Principle of reversibility, Reflection through mirrors and lenses, Imaging by optical system, Refraction, Vergence and Refractive power, 1-D wave equation, Harmonic, Plane, Spherical and Electromagnetic waves, Superposition of waves, beam interference, Standing waves, Phase and group velocities, Michelson interferometer and its application, Fabry-perot interferometer, Diffraction, Polarization and mathematical treatment of polarized light and polarizer. | | | |
| **Expected**  **Outcomes** | Participants will learn calculus based general Optics approach. They will also be ready for Opto-Electronics, Lasers and Spectroscopy courses. | | | |
| **Text**  **Book** | Introduction to Optics, Frank L. Pedrotti, S.J., Leno S. Pedrotti, Leno M. Pedrotti, 3rdEdition, Pearson Prentice Hall, 2007. | | | |
| **Assignment & Projects** | i). Problems will be assigned at regular intervals as an assignment.  ii). Projects on different topics may also be assigned to the students.  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 +Projects+ Quizzes: 30 %  Mid Term Examination: 30 %  Final Examination: 40 % | | | |

Optics

**Lecture Plan (Spring 2023)**

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| **Week** | **Lecture**  **#** | **TOPICS** | **CH** | **Sections** |
| 1 | 1  2 | Introduction, Particles and Photons, The Electromagnetic Spectrum  Radiometry | 01  01 | 1 – 3  4 |
| 2 | 1  2 | Huygens’ Principle, Fermat’s Principle, Principle of reversibility  Reflection in plane mirrors, planes surfaces and spherical surfaces, Imaging by optical system | 02  02 | 1 – 3  4 – 7 |
| 3 | 1  2 | Refraction at spherical surface, Thin lenses, Vergence and Refractive power  Newtonian equation, Cylindrical lenses | 02  02 | 8 – 10  11 – 12 |
| 4 | 1  2 | One dimensional wave equation, Harmonic wave  Plane waves, Spherical waves, Electromagnetic waves | 04  04 | 1 – 4  5 – 8 |
| 5 | 1  2 | Light polarization, Doppler effect  Superposition principle, Superposition of waves | 04  05 | 9 – 10  1 – 2 |
| 6 | 1  2 | Random and Coherent sources, Standing waves  The Beat phenomenon, Phase and group velocities | 05  05 | 3 – 4  5 – 6 |
| 7 | 1  2 | Two beam interference  Young double slit experiment, Double slit experiment with virtual source | 07  07 | 1  2 – 3 |
| 8 | 1  2 | Interference in dielectric films, Fringes of equal thickness, Newton’s ring  Film thickness measurement, Stokes relation, Multiple beam interference | 07  07 | 4 – 6    7 – 9 |
| 9 | 1  2 | Michelson interferometer and its application, Variation of Michelson interferometer  Fabry-perot interferometer, Fabry-perot transmission | 08  08 | 1 – 3  4 – 5 |
| 10 | 1  2 | Scanning Fabry-perot interferometer, Variable-input frequency Fabry-perot interferometer  Lasers and Fabry-perot Cavity, Fabry-perot figures of merit, Gravitational wave detectors | 08  08 | 6 – 7  8 - 10 |
| 11 | 1  2 | Diffraction from single slit, Beam spreading  Rectangular and circular apertures, Resolution | 11  11 | 1 – 2  3 – 4 |
| 12 | 1  2 | Double slit diffraction, Diffraction from many slits  Grating equation, Spectral range, dispersion and resolution of a grating | 11  12 | 5 – 6  1 – 4 |
| 13 | 1  2 | Types of grating, Blazed grating, Grating replicas  Interference gratings, Grating instruments | 12  12 | 5 - 7  8 – 9 |
| 14 | 1  2 | Mathematical representation of polarized light  Mathematical representation of polarizer | 14  14 | 1  2 |
| 15 | 1  2 | Polarization by absorption, reflection and scattering  Polarization with two refractive indices. Double refraction, Optical cavity, Photo elasticity | 15  15 | 1 – 3  4 – 7 |