** 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 | 12 | Introduction, Particles and Photons, The Electromagnetic SpectrumRadiometry  | 0101 | 1 – 34 |
| 2 | 12 | Huygens’ Principle, Fermat’s Principle, Principle of reversibilityReflection in plane mirrors, planes surfaces and spherical surfaces, Imaging by optical system | 0202 | 1 – 34 – 7 |
| 3 | 12 | Refraction at spherical surface, Thin lenses, Vergence and Refractive powerNewtonian equation, Cylindrical lenses | 0202 | 8 – 1011 – 12 |
| 4 | 12 | One dimensional wave equation, Harmonic wavePlane waves, Spherical waves, Electromagnetic waves | 0404 | 1 – 45 – 8 |
| 5 | 12 | Light polarization, Doppler effectSuperposition principle, Superposition of waves | 0405 | 9 – 101 – 2 |
| 6 | 12 | Random and Coherent sources, Standing wavesThe Beat phenomenon, Phase and group velocities | 0505 | 3 – 45 – 6 |
| 7 | 12 | Two beam interferenceYoung double slit experiment, Double slit experiment with virtual source | 0707 | 12 – 3 |
| 8 | 12 | Interference in dielectric films, Fringes of equal thickness, Newton’s ringFilm thickness measurement, Stokes relation, Multiple beam interference  | 0707 | 4 – 6 7 – 9 |
| 9 | 12 | Michelson interferometer and its application, Variation of Michelson interferometerFabry-perot interferometer, Fabry-perot transmission  | 0808 | 1 – 34 – 5 |
| 10 | 12 | Scanning Fabry-perot interferometer, Variable-input frequency Fabry-perot interferometerLasers and Fabry-perot Cavity, Fabry-perot figures of merit, Gravitational wave detectors | 0808 |  6 – 78 - 10 |
| 11 | 12 | Diffraction from single slit, Beam spreadingRectangular and circular apertures, Resolution | 1111 | 1 – 2 3 – 4 |
| 12 | 12 | Double slit diffraction, Diffraction from many slits Grating equation, Spectral range, dispersion and resolution of a grating | 1112 | 5 – 61 – 4 |
| 13 | 12 | Types of grating, Blazed grating, Grating replicasInterference gratings, Grating instruments | 1212 | 5 - 78 – 9 |
| 14 | 12 | Mathematical representation of polarized lightMathematical representation of polarizer | 1414 | 12 |
| 15 | 12 | Polarization by absorption, reflection and scatteringPolarization with two refractive indices. Double refraction, Optical cavity, Photo elasticity | 1515 | 1 – 34 – 7 |