9/15/2022 DATE
☑ REQUIRED COURSE
☐ ELECTIVE COURSE

MSD DIVISION
☐ NEW COURSE
☑ REVISION

# Lake Land College

## Course Information Form

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|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE NUMBER: | PHY-142 | | TITLE: *(30 Characters Max)* | University Physics III | | | | | | | |
| SEM CR HRS: | 4 | Lecture: | 3 | Lab: | 3 | | | | | ECH: | 6 |
| Course Level: | ☑ Gen Ed / IAI ☐ Career/Technical ☐ Baccalaureate /Non-IAI ☐ Dev Ed/ Not in Degree Audit | | | Clinical Practicum: | 0 | Work-based Learning: | 0 | WBL ECH: | 0 | | |
| COURSE PCS # | 11 - 40.0801 | | IAI Code | PHY914 | | | | Contact Hours (Minutes Per Week) | | | |
| Repeatable (Y/N): | N | Pass/Fail (Y/N): | N | Variable Credit (Y/N): | N | Min: | | Max: | | 16 Wks | 300 | 8 Wks | 600 |
| Prerequisites: | PHY-141 with grade of "C" or higher | | | | | | | | | | |
| Corequisites: | MAT-243 | | | | | | | | | | |
| Catalog Description: (40 Word Limit) | This course is a study of wave motion, sound, light, and modern physics for students in physics, engineering, chemistry, and mathematics. | | | | | | | | | | |

| List the Major Course Segments (Units) | Contact Lecture Hours | Contact Lab Hours | Clinical Practicum | Work-based Learning |
|---|---|---|---|---|
| Waves in Elastic Media | 4 | 5 | | |
| Sound and General Wave Phenomena | 4 | 6 | | |
| Geometric Optics | 5 | 5 | | |
| Interference and Diffraction | 5 | 6 | | |
| Introduction to Special Relativity | 4 | 2 | | |
| Light and Quantum Physics, Waves and Particles | 6 | 5 | | |
| One Electron Atoms - Schröedinger Equation | 4 | 3 | | |
| Conductors, Insulators, and Semiconductors | 4 | 4 | | |
| Introduction to Nuclear Physics and Nuclear Energy | 3 | 3 | | |
| Particle Physics and The Standard Model | 3 | 3 | | |
| Quantum Mechanics (Selected Advanced Topics) | 3 | 3 | | |
| TOTAL | 45 | 45 | 0 | 0 |

| EVALUTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| QUIZZES | ☑ | EXAMS | ☑ | ORAL PRES | ☑ | PAPERS | ☑ |
| LAB WORK | ☑ | PROJECTS | ☐ | COMP FINAL | ☑ | OTHER | ☑ homework |

| COURSE MATERIALS | | |
|---|---|---|
| TITLE: | Fundamentals of Physics (Extended) | |
| AUTHOR: | Halliday, Resnick, & Walker | |
| PUBLISHER: | John Wiley & Sons | |
| VOLUME/EDITION/URL: | 9th | |
| COPYRIGHT DATE: | 2011 | |

| MAJOR COURSE SEGMENT | HOURS | LEARNING OUTCOMES |
|---|---|---|
| | | *The student will be able to:* |
| ONE-DIMENSIONAL WAVES<br>Wave Dimension<br>Particle Behavior in Time<br>Waves Traveling on a String<br>Wave Pulses<br>Sinusoidal Wave Train<br>Longitudinal Waves<br>Wave Velocity on a String<br>Energy Transported by Sinusoidal Waves<br>Superposition and Interference of Waves<br>Wave Interference<br>Adding Waves That Differ in Phase Only: Interference<br>Adding Waves That Differ in Frequency Only: Beats<br>Adding Waves That Differ in Direction Only: Standing Waves<br>Wave Reflection | 9 | Demonstrate different types of waves.<br>Demonstrate how waves interact with each other and with the environment.<br>Do calculations and draw appropriate pictures of wave resonance patterns. |

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| SOUND<br>Models for Sound Waves in a Gas<br>The Velocity of Sound<br>Harmonic Waves in Air<br>Sound Intensity and Sound Intensity Level<br>The Decibel Scale<br>Sources of Sound<br>Vibrating Strings<br>Air Columns<br>Resonance and Beats<br>The Doppler Effect<br>Shock Waves | 10 | Demonstrate how sound waves are produced and how they interact in different situations.<br>Demonstrate the concepts of sound intensity, sound intensity level, and the Doppler Effect. |
| REFLECTION, REFRACTION AND POLARIZATION OF LIGHT<br>Particles and Waves: A Tale of Two Models<br>Properties of the Wave Model of Light<br>Wavefronts and Rays<br>Huygens' Principle<br>The Ray Model<br>Reflection<br>Refraction<br>Total Internal Reflection<br>Polarization<br>Polarization by Scattering<br>Polarization by Reflection<br>Wire-Grid Polarizers | 5 | Demonstrate properties of light including reflection, refraction, and polarization. |
| GEOMETRICAL OPTICS<br>Images<br>Images Formed by Plane Mirrors<br>Images Formed by Curved Mirrors<br>Concave Mirrors<br>Convex Mirrors<br>Images Formed by Lenses<br>The Lens-Maker's Formula<br>The Thin-Lens Formula | 5 | Use Snell's Law, Lenses, and Mirrors to analyze and create ray traces. |
| DIFFRACTION OF LIGHT<br>Single-Slit Diffraction<br>Diffraction-Limited Optics<br>Resolution<br>Diffraction Gratings (Optional) | 11 | Demonstrate single and double slit interference and diffraction. |
| THE SPECIAL THEORY OF RELATIVITY<br>Galilean Transformation and Invariance<br>Experimental Basis for the Special Theory of Relativity<br>Michelson-Morley Experiment<br>Aberration of Starlight<br>Postulates of the Special Theory of Relativity<br>Synchronization of Clocks<br>Measurement of Transverse Lengths<br>Time Dilation<br>Measurement of Longitudinal Lengths<br>Clock Synchronization Revisited<br>Lorentz Transformation<br>Time Dilation<br>Length Contraction<br>Clock Synchronization<br>Velocity Transformations<br>Relativistic Momentum and Energy | 6 | Demonstrate and explain physical events using the Lorentz transformation equations of Special Relativity as well as the major energy and momentum consequences of Special Relativity.<br>Demonstrate the role of measurement in Special Relativity. |
| PARTICLELIKE NATURE OF RADIATION<br>Blackbody Radiation<br>Photoelectric Effect<br>Photoelectric Effect and Classical Physics<br>Quantum Interpretation of the Photoelectric Effect<br>Compton Effect | 5 | Demonstrate the particle-like behavior of radiation and use it to explain blackbody radiation and the photoelectric effect. |
| WAVELIKE NATURE OF MATTER<br>Atomic Line Spectra<br>Early Atomic Models<br>Bohr Model<br>Matter Waves<br>Experimental Evidence of Matter Waves<br>Uncertainty Principle | 6 | Demonstrate the wave-like behavior of matter. |

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| QUANTUM-MECHANICS<br>Wave Function<br>The Schrödinger Equation<br>Particle in a Box<br>Quantum States<br>Simple Harmonic Oscillator<br>Free Particle<br>Reflection and Transmission by a Potential-Energy Barrier<br>Alpha Decay<br>Scanning Tunneling Microscope | 7 | Use the basic quantum systems to explain physical theories: particle in a box, harmonic oscillator, quantum tunneling. |
| SOLID-STATE PHYSICS<br>Bonding in Crystals<br>Ionic Bonding<br>Covalent Bonding<br>Metallic Bonding<br>Free-Electron Model<br>Fermi Energy<br>Fermi-Dirac Distribution Function<br>Electrical Conductivity of Metals<br>Energy Bands and Semiconductors<br>Superconductivity | 8 | Demonstrate bonding, conductivity, and semiconductors in solid-state materials. |
| NUCLEAR PHYSICS<br>Nuclear Structure<br>Radioactive Decay Law<br>Forms of Radioactivity<br>Energy in Nuclear Reactions<br>Nuclear Fission<br>Nuclear Fusion<br>Nucleosynthesis<br>Radioactive Dating | 6 | Demonstrate nuclear structure, radioactivity, and nuclear energy generation. |
| PARTICLE PHYSICS<br>Fundamental Particles<br>Standard Model<br>Basic Forces<br>Cosmology | 6 | Describe the direction of modern particle physics and the standard model. |
| ADVANCED TOPICS IN QUANTUM MECHANICS | 6 | |
| | 90 | |

| Outcomes* | At the successful completion of this course, students will be able to: |
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| Course Outcome | Demonstrate traveling waves and standing waves, the latter as they relate to waves on a string and to air columns. (To be able to do calculations and draw appropriate pictures of wave resonance patterns.) |
| Course Outcome | Demonstrate the concepts of sound intensity, sound intensity level, and the Doppler Effect. |
| Course Outcome | Utilize Snell's Law, Lenses, and Mirrors to analyze and create ray traces. |
| Course Outcome | Demonstrate single and double slit interference and diffraction. |
| Course Outcome | Demonstrate and explain physical events using the Lorentz transformation equations of Special Relativity as well as the major energy and momentum consequences of Special Relativity. Demonstrate the role of measurement in Special Relativity. |
| Course Outcome | Utilize the several basic quantum systems to explain physical theories: particle in a box, harmonic oscillator, quantum tunneling. |
| Course Outcome | Demonstrate bonding, conductivity, and semiconductors in solid-state materials. |
| Course Outcome | Demonstrate nuclear structure, radioactivity, and nuclear energy generation. |
| Course Outcome | Describe the direction of modern particle physics and the standard model. |
| Primary Laker Learning Competency | |
| Secondary Laker Learning Competency | |

**Course and program outcomes will be used in the software for outcomes assessment and should include at least 1 primary and 1 secondary Laker Learning Competency. Limit to 3-5.*