Comprehensive Course Syllabus

Course Title: Physics: Sound and Light

Course Number: SCI402

Prerequisite: Scientific Inquiries - Physics or equivalent and Mathematical Investigations III.

Course Description:
The purpose of this course is to provide students with the concepts needed to understand waves, sound, and light. This course presents material on mechanical oscillations, wave properties and interactions, sound, resonances and musical instruments, light, and optics. The course is a hands-on, inquiry-based course, with an emphasis on lab and project work.

Instructors:

- Name: Dr. Peter Clancy / Ms. Brooke Schmidt
- Offices: B-104A / B-105A
- Phone: x5986 / x5942
- Email: pclancy@imsa.edu / bschmidt@imsa.edu

- All classes meet in room B101

Text(s) / Materials: Essentials of College Physics, Serway & Vuille
Moodle website https://courses.imsa.edu/course/view.php?id=433
Quest Learning & Assessment website: https://quest.cns.utexas.edu/

Essential Content:

- Oscillations (spring-mass system, pendulums)
- Waves and wave characteristics and phenomena: velocity, frequency, wavelength, amplitude, affect of medium, reflection, refraction, resonance, superposition
- Sound: Pitch, intensity, decibels, power, beats, interference, Doppler effect
- Application of sound to musical instruments
- Optics: Mirrors, lenses, ray diagrams, EM spectrum, refraction, Snell's law
- Application of optics to optical instruments and telescopes

Instructional Design and Approach:

Students encounter the material through a multifaceted approach of classroom discussion, problem-solving, demonstration, laboratory activities and experiments. Both large and small group discussions are used to provide the students the opportunity to learn from each other.

Problem solving is central to the design and implementation of this course. Students work individually, in small groups, and as a class to solve problems. Problems are chosen to integrate concepts throughout the course.

Student Expectations:
Students are expected to follow the attendance and tardy policies of the Academy. They are expected to come to class prepared with their assignments done and ready to ask questions and discuss topics with classmates. Outside of class, students are expected to read from the text, write in their journals, and work on projects and problem sets. Refer to the student handbook for more details.

Academic Responsibility

A. Students are expected to arrive in class on time. Unexcused tardies in excess of 5 minutes will only gain admittance with a pass from the Attendance Office. Please refer to the Attendance and Tardiness Procedures section of the handbook.
Work cannot be made up for unexcused absences.

B. Students are expected to bring proper materials to class including.
   1. Calculator
   2. Laptop computer
   3. Pen/pencil and paper and Notebook of Sound and Light

C. Students are expected to submit all assigned work by the designated time. Late work will receive penalties as determined by each instructor.

D. When in class, students are expected to be alert, to listen intently, and to actively participate in class activities scheduled for the day.

E. Students are expected to use their tablet computers to support class instruction. If a student is off task on his/her tablet or otherwise during class time, the instructor may mark the student absent after an initial warning.

F. Work missed during a counselor excused absence may or may not be made up at the discretion of the instructor.

G. Students are expected to leave class with notes from the lesson of the day.

H. Students should get help early. Options include:
   1. Office Hours/ Appointment with instructor
   2. Peer Tutor
   3. Email instructor

Laboratory Policies

Violating safety rules may result in penalties or students may not receive credit for that activity/experiment. We encourage collaboration between partners. However, each partner is expected to do his/her own work.

Ethics

Honesty is a key component of scientific work, whether on the forefront of scientific research or in an IMSA laboratory. The practices (both good and bad) that are learned in

an IMSA lab greatly influence your education. Consequently any violation of the honesty policy is considered a serious offense.

Examples of Violations:

1. Falsification of data; fabricating or changing data in your notebook or formal reports. NOTE: It often happens that, in performing an experiment, "obviously" bad data is obtained. It is NOT acceptable to simply discard the suspect data; however, you should include a short note or explanation of why you are disregarding the data.
2. Plagiarism: representing another's work as your own; submitting written reports with sections directly or indirectly quoted from another source without referencing that source.

Working Together, where to draw the line:

In experiments done with partners, it is expected that you will share data and observations. It is expected that you will always discuss the experiment and exchange ideas with your partner(s), other students, your instructors, etc. However, unless specifically told otherwise, each report is an **individual report**. By signing your name to it, you testify that the ideas, calculations, results, discussions and conclusions are yours alone, except as referenced. Copying, borrowing, lending or sharing of the words and work of or with another, (directly or by paraphrasing) is plagiarism. Simply put, all intellectual exchanges **before** writing the report are acceptable. Unreferenced use of another's written material or joint production of a written report is not acceptable, unless you are specifically told to write a group report. Consequences of violating these rules are explained in the student/parent handbook. These guidelines also apply to the completion of homework assignments (problem sets) as well.

Assessment Practices, Procedures, and Processes:

Assessments such as in class presentations, projects, problem solving activities, laboratory reports, unit exams, quizzes, and a comprehensive final exam provide students opportunities to demonstrate what they have learned. Tests will be given at the end of each unit. Problem sets and lab data and analysis are formative in nature and laboratory reports and exams are summative.

The primary components for assessment in the course include:

50% Unit Tests (4) and Quizzes

5% Homework

30% Labs and Projects

15% Final Exam

``

Grading Scale:

93-100	A,	90-92	A-		
87-89	B+,	83-86	B,	80-82	B-,
77-79	C+,	73-76	C,	70-72	C-,
Below 70	D				

This grading scale assumes appropriate rounding to zero decimal places.

Sequence of Topics and Activities and Approximate Schedule:

1: Oscillations and Waves (6 class days)

2: Sound (8 class days) Includes musical instrument project

3: Light and mirror optics (6 class days)

4: Lens optics (7 class days) Includes telescope project

Science Learning Standards

A. Students studying science at IMSA engage in the process of scientific inquiry by:

A.1 applying the skills of observation (describe, compare, and contrast characteristics; identify parameters, precisely observe phenomena).
A.3 carrying out investigations that develop skills, concepts, and processes that support and enable complex thought.
A.4 using appropriate technologies to collect, analyze and present information.
A.5 accurately recording findings.
A.7 employing scientific reasoning to evaluate the soundness and relevance of information.
A.8 constructing and supporting judgments based on evidence.
A.9 sharing results by communicating orally, in writing, and through display with power, economy, and elegance.

B. Students studying science at IMSA demonstrate understanding of energy and matter by:

B.3 applying the principles of conservation of mass, conservation of charge, and conservation of energy to a variety of problems and situations.

C. Students studying science at IMSA demonstrate understanding of force and motion by:

C.1 using graphical and mathematical representations to analyze and predict the motion of objects.
C.2 using Newton's Laws to relate force and motion.

Standards of Significant Learning and Outcomes:

The principal standards of significant learning addressed in this course are:

IA. Students expected to demonstrate automaticity in skills, concepts, and processes that enable complex thought by

- completing assigned problem sets. **FA**
- demonstrating proper use of laboratory equipment. **IA**
- demonstrating competence on quizzes and exams. **FA**

IB. Students expected to construct questions which further understanding, forge connections and deepen meaning by

- setting up laboratory experiments appropriately. **FA**
- analyzing data to draw conclusions. **FA**
- discussing labs and problem sets with peers. **NA**
- modeling systems supported by data/observations. **FA**

IC. Students expected to precisely observe phenomena and accurately record findings through

- data collection and observations. **FA**
- analysis of data generated from experiments. **FA**

ID. Students expected to evaluate the soundness and relevance of information and reasoning by

- drawing conclusions from laboratory data. **FA**
- evaluating the reasonableness of answers. **FA**
- evaluating models created from data/observations. **FA**

IIA. Students identify unexamined personal assumptions and misconceptions that impede and skew inquiry

- by completing pre-assessments and/or practice problems to solicit misconceptions. **IA**
- by reconciling data/observations and preconceptions. **FA**
- through assessment questions targeted at misconceptions. **FA**

IIIA. Students use appropriate technologies as extensions of the mind through

- daily use of tablets for completing work and referencing resources. **NA**
- use of calculators for problem solving. **NA**
- use of computer to collect and analyze data. **IA/FA**
- use of laboratory equipment for data analysis. **NA/IA**

IIIB. Students recognize, pursue, and explain substantive connections within and among areas of knowledge by

- connecting previous concepts in physics to current concepts through work in lab and problem sets. **IA/FA**
- applying content knowledge to alternative scenarios and/or new problems. **FA**

IIIC. Students recreate beautiful conceptions that give coherence to structures of thought by

- exploring the development of models (mathematical and conceptual). **NA**
- connecting concepts in physics to real world scenarios. **NA**

IVA. Students construct and support judgments based on evidence by

- drawing appropriate conclusions in lab work supported by data/analysis. **FA**

IVB. Students write and speak with power, economy, and elegance by

- communicating effectively in lab work/reports. **IA**
- explaining problems and asking questions during group discussions. **NA**
- showing work to clearly communicate problem solutions. **IA**

IVC. Students identify and characterize composing elements of systems

- through effectively laboratory set-ups to collect data appropriate to question. **IA**
- by breaking down a complicated problem in order to solve it. **IA**

VB. In order for students to make reasoned decisions which reflect ethical standards, and act in accordance with those decisions, students by

- accurately reporting data even if it seems problematic. **IA**
- submitting lab work and problem sets representing individual student work. **IA**