## Items of Course Outlines

1. Instructor (s) – Name and Contact Details

Jingdi Zhang
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2. Teaching Assistant (s) - Name and Contact Details

Yuehua Wu

ywufu@connect.ust.hk

3. Meeting Time and Venue – Lectures, Tutorials/ Laboratory

No tutorial/no lab for the course

4. Course Description - Credit Points, Pre-requisite, Exclusion, Brief Information/synopsis

PHYS 3038 is an introduction course on optics, including the following key topics:

electromagnetic theory of wave propagation, ray and wave optics, light-matter interaction, advanced geometrical optics, optical instruments, polarization, diffraction & interference, Fourier optics, Coherence theory, laser and holography and nonlinear optics. Some practical examples and demonstrations will be provided. Prior knowledge on electromagnetic field and electromagnetic waves is recommended.

5. Intended Learning Outcomes

*(State what the student is expected to be able to do at the end of the course according to a given standard of performance)*

Upon the end of the course, students should be able to:

1. Formulate and solve problems in optics at undergraduate level.
2. Compare and contrast the propagation of light by ray optics and wave optics
3. Analyze and explain polarization, birefringence, interference and diffraction phenomena observed in our daily life such as color fringe seen on oil film on water, anti-reflection coating on eye glasses, polarized reflected light etc.
4. Explain the basic working principles for some simple optical instruments such as microscope, telescope and camera.
5. Apply the course material learned to understand and solving practical problems particularly in the area related to optics and optical devices.
6. Principle of lasers and optical metrology

6. Assessment Scheme

| Assessment<br>*(Percentage + assessment tasks)* | Assessing Course ILOs<br>*(Respective course ILOs)* |
|---|---|
| Homework : 30% | |
| Midterm exam : 30% | |
| Final exam: 40% | |

7. Student Learning Resources - Lecture Notes, Readings

   (Textbook) OPTICS, by Eugene Hecht, Pearson New International Edition (4th or 5th Edition).

   (Other references) INTRODUCTION TO MODERN OPTICS, Grant R. Fowles;

8. Teaching and Learning Activities -
   a. Lectures: focus on …..
   b. Tutorials/Laboratory: focus on…..

9. Course Schedule

   *a. Topics taught*

   *E&M Theory; Wave; Radiation; Light-matter interaction; Propagation of light; Fresnel equations; Total internal reflection; Metals; Geometrical Optics; Superposition of waves; Polarization; Interference; Diffraction; Fourier Optics; Lasers; Nonlinear optics;*

   *b. Weeks or dates of teaching specific topics (optional)*

## Sample

**PHYS1200 Fundamental Physics**

**Course Outline- Fall 2012**

1. **Instructor(s)**

   *Name:*

   *Contact Details:*

2. **Teaching Assistant(s)**

   *Name:*

   *Contact Details:*

3. **Meeting Time and Venue**

   *Lectures:*

   **Date/Time:** Wednesday and Friday (13:30 – 15:30)

   **Venue:** Classroom 2464

   *Tutorials:*

   **Date/Time:** Thursday (14:00-15:00)

   **Venue:** LTA

4. **Course Description**

   Credit Points: 3

   Pre-requisite: NIL

   Exclusion: NIL

   Brief Information/synopsis:

   This course covers a wide scope of topics in classical physics and some modern physics, including mechanics, kinetic theory of gases, optics, electricity, magnetism, atomic physics and materials concepts. Students will investigate the fundamentals of these topics and become able to apply them to solve real problems in science and engineering. Basic mathematical tools such as algebra and vector notation will be introduced and used in the course.

## 5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

| No. | ILOs |
|---|---|
| 1 | Recognize and use appropriately important technical terms and definitions. |
| 2 | Use simple calculus and vector notation to formulate and apply the laws in concise form. |
| 3 | Apply physics laws of mechanics, thermodynamics, waves, optics, electricity and magnetism in familiar situations. |
| 4 | Solve real and hypothetical problems by identifying the underlying physics and analyzing the problem. |

## 6. Assessment Scheme

a. Examination duration: 2 hrs

b. Percentage of coursework, examination, etc.:

| Assessment | Assessing Course ILOs |
|---|---|
| 40% by coursework | 1, 2, 3 |
| 10% discussion report & participation | 4 |
| 50% by exam | 1, 2, 3, 4 |

c. The grading is assigned based on students' performance in assessment tasks/activities.

## 7. Student Learning Resources

Recommended Reading:

Text(s):

D Halliday, R Resnick, and J Walker, "Fundamentals of Physics", Wiley.

R A Serway and J W Jewett, "Physics for Scientists and Engineers with Modern Physics", Thomson – Brooks / Cole.

## 8. Teaching and Learning Activities

Scheduled activities: 4 hrs (lecture + tutorial)

## 9. Course Schedule

Keyword Syllabus:

- Mechanics: Vectors and scalars. Resolving forces. Newton's laws of motion. Conservation of energy. Moments and torques. Gravitation. Circular motion.
- Thermodynamics: Temperature and heat. Heat capacity. Latent heat. Thermal expansion. Gas laws. Kinetic theory of gases.
- Waves: Traveling waves. Standing waves. Huygens' construction. Interference, refraction and diffraction. Doppler effect.
- Optics: Reflection. Refraction. Lenses.
- Electrical properties: Conduction of electricity in solids. Resistance and resistivity.
- Electric fields: Coulomb's law. Field lines. Electric potential. Capacitors.
- Magnetism: Field due to magnets and currents. Definition of B. Force on a wire carrying a current in a uniform magnetic field. Electromagnetic induction. Faraday's law. Lenz's law.
- Atomic physics: Development of the model of the atom. Particle-wave duality. Basics of quantum mechanics. Electrons as waves. Photoelectric effect. Electronic transitions.
- Materials: Metals. Semiconductors. Insulators. Polymers. Nanomaterials.