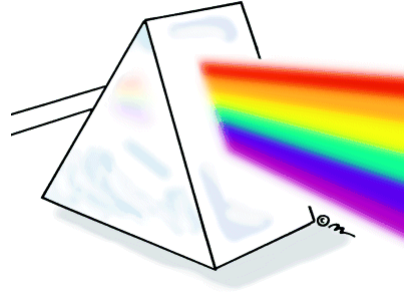




EP118 Optics

TOPIC 0 INTRODUCTION TO COURSE



Department of Engineering Physics
University of Gaziantep

Feb 2011

Sayfa 1

Introduction

- Light is the portion of electromagnetic radiation that is visible to the human eye.
- Optics is the branch of physics which involves the behavior and properties of light and interactions of light with matter such as
 - reflection
 - refraction
 - interference
 - diffraction
 - polarization
 - etc.
- Optics has many engineering applications such as the construction of instruments to use and detect the light.

Sayfa 2

The Course Web Page

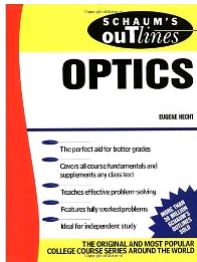
- Course web page

<http://www.gantep.edu.tr/~bingul/ep118>

- Also search *Google* and *Wikipedia* for any of the expressions used in this course.

Sayfa 3

The Course Books

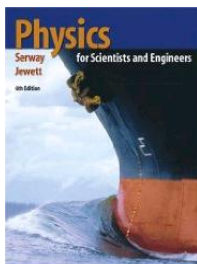


Optics

Eugene Hecht

Schaum Outline Series

~ 25 \$



Physics for Scientists and Engineers

6th Edition

R. A. Serway and J. W. Jewett

Brooks Cole

~ 50 \$

Sayfa 4

The Course Content

1. Light

- History
- Wave nature
- Particle nature
- ...

2. Reflection and Refraction

- Fermat's Principle
- Prisms

3. Mirrors and Lenses

4. Wave Optics

- Interference
- Diffraction
- Polarization

5. Optical Instruments

- Microscope
- Telescope
- Camera
- ...

6. Aberrations

- Spherical Aberration
- Chromatic Aberration

7. Photometry

- Radiometry
- Photometry

8. Optoelectronic Devices

- LED
- Laser
- LDR
- Photo-diode
- ...

9. Advanced Topics

- Holography
- Fiber Optics
- Photonics

Sayfa 5

Lectures, Attendance, Exams

FIRST EDUCATION

▪ Mondays & Fridays

13:30-15:20 Engineering of Physics S1-S3-S4

▪ Attendance

You must attend at least 70% of the course

▪ Exams

- 1st midterm 30%
- 2nd midterm 30%
- Final 40%

Sayfa 6

Lectures, Attendance, Exams

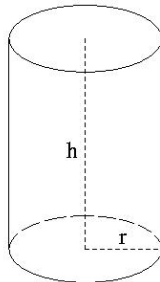
SECOND EDUCATION

- **Teusdays & Wednesdays**
18:50-20:35 Engineering of Physics S3
- **Attendance**
You must attend at least 70% of the course
- **Exams**
 - 1st midterm 30%
 - 2nd midterm 30%
 - Final 40%

Sayfa 7

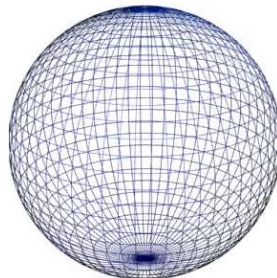
Basic Mathematical Formulas

Geometry



$$V = \pi r^2 h$$

$$A = 2\pi r h + 2\pi r^2$$

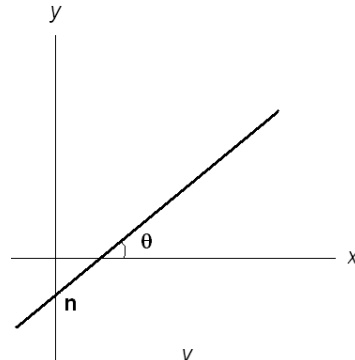


$$V = \frac{4}{3} \pi r^3$$

$$A = 4\pi r^2$$

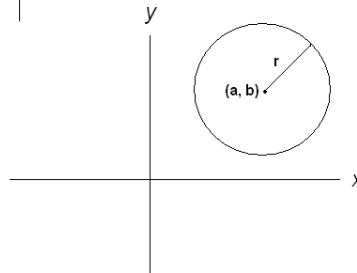
Sayfa 8

Analytic Geometry



$$y = mx + n$$

$$m = \tan \theta$$



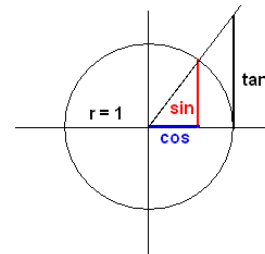
$$(x-a)^2 + (y-b)^2 = r^2$$

Sayfa 9

Trigonometry

$$\begin{array}{l} \sin(-\theta) = -\sin \theta \quad \left| \sin\left(\frac{\pi}{2} - \theta\right) = +\cos \theta \quad \left| \sin(\pi - \theta) = +\sin \theta \right. \right. \\ \cos(-\theta) = +\cos \theta \quad \left| \cos\left(\frac{\pi}{2} - \theta\right) = +\sin \theta \quad \left| \cos(\pi - \theta) = -\cos \theta \right. \right. \\ \tan(-\theta) = -\tan \theta \quad \left| \tan\left(\frac{\pi}{2} - \theta\right) = +\cot \theta \quad \left| \tan(\pi - \theta) = -\tan \theta \right. \right. \end{array}$$

$$\begin{array}{l} \sin\left(\theta + \frac{\pi}{2}\right) = +\cos \theta \quad \left| \sin(\theta + \pi) = -\sin \theta \quad \left| \sin(\theta + 2\pi) = +\sin \theta \right. \right. \\ \cos\left(\theta + \frac{\pi}{2}\right) = -\sin \theta \quad \left| \cos(\theta + \pi) = -\cos \theta \quad \left| \cos(\theta + 2\pi) = +\cos \theta \right. \right. \\ \tan\left(\theta + \frac{\pi}{2}\right) = -\cot \theta \quad \left| \tan(\theta + \pi) = +\tan \theta \quad \left| \tan(\theta + 2\pi) = +\tan \theta \right. \right. \end{array}$$



$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

$$\begin{aligned} \sin 2\theta &= 2 \sin \theta \cos \theta \\ &= \frac{2 \tan \theta}{1 + \tan^2 \theta} \end{aligned}$$


$$\begin{aligned} \cos 2\theta &= \cos^2 \theta - \sin^2 \theta \\ &= 2 \cos^2 \theta - 1 \\ &= 1 - 2 \sin^2 \theta \\ &= \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta} \end{aligned}$$

$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

Sayfa 10

Taylor Series Expansions

for all x

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$
$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots$$


x is radian

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \dots$$

if x is small then we can use the approximations

$$\sin x \approx x$$

$$\cos x \approx 1$$