

OPT-1320: THEORETICAL OPTICS II

Cuyahoga Community College

Viewing: OPT-1320 : Theoretical Optics II

Board of Trustees:

January 2024

Academic Term:

Fall 2024

Subject Code

OPT - Optical Technology

Course Number:

1320

Title:

Theoretical Optics II

Catalog Description:

Study of theories of light, geometric laws of refraction, modern lens theory, and construction as it relates to finishing, surfacing, and dispensing of complex and special lens types. Includes calculation of refractive errors, corrective methods and calculating American National Standards Institute (ANSI) standards for complex ophthalmic eyewear.

Credit Hour(s):

2

Lecture Hour(s):

2

Lab Hour(s):

0

Other Hour(s):

0

Requisites

Prerequisite and Corequisite

OPT-1310 Theoretical Optics I.

Outcomes

Course Outcome(s):

Apply comprehensive analysis of geometric optics, modern lens theory, and construction when designing, verifying and dispensing spectacles and contact lenses.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Demonstrate skills in complex prescription analysis and interpretation anticipating and avoiding possible problems.
 2. Combine the knowledge of ophthalmic lenses and frames with the analysis of the patient's refractive error to design the most effective spectacles or contact lenses.
 3. Determine the appropriate diameter, base curve and prescription when fitting contact lenses.
 4. Apply complex geometrical formulae to verify that spectacle and contact lenses are within national standards put forth by the American National Standards Institute (A.N.S.I.), Food and Drug Administration (F.D.A.), Occupational Safety and Health Administration (O.S.H.A.).
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Course Outcome(s):

Calculate measurements necessary to the fabrication of contact lenses.

Objective(s):

1. Analyze information about lens characteristics with reference to the patient's prescription to design the most effective spectacle or contact lenses.
2. Determine the appropriate diameter, base curve, and prescription when fitting contact lenses.

Course Outcome(s):

Evaluate the patient's prescription, anticipating possible problems, to design the best possible lenses to correct visual deficiencies.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Demonstrate skills in complex prescription analysis and interpretation anticipating and avoiding possible problems.
2. Analyze information about lens characteristics with reference the patient's prescription to design the most effective spectacle or contact lenses.
3. Determine the appropriate diameter, base curve, and prescription when fitting contact lenses.

Course Outcome(s):

Apply the standards put forth by the American National Standards Institute, the Federal Trade Commission and the United States Food and Drug Administration as they apply to verification of spectacles and contact lenses.

Objective(s):

1. Document the policies of the American National Standards Institute (A.N.S.I.), Food and Drug Administration (F.D.A.), Occupational Safety and Health Administration (O.S.H.A.) to analyze and interpret spectacles and contact lenses prescriptions.
2. Apply complex geometrical formulae to verify that spectacle and contact lenses are within national standards put forth by the American National Standards Institute (A.N.S.I.), Food and Drug Administration (F.D.A.), Occupational Safety and Health Administration (O.S.H.A.).

Methods of Evaluation:

1. Exams
2. Group Projects
3. Homework
4. Participation

Course Content Outline:

1. Concepts:
 - a. Contact lenses
 - i. Diameter
 - ii. Base curve
 - iii. Power
 - iv. Determining appropriate axis
 - b. Spectacle lenses
 - i. Determine total lens power
 1. Spherocylinder power
 2. At the 180th meridian
 3. At the 90th meridian
 - ii. Determining base curves
 - iii. True power
 - iv. Nominal power
 - v. Spherical equivalent
 - vi. Lens properties

1. Aberrations
 - a. Coma
 - b. Marginal astigmatism
 - c. Spherical
 - d. Nu value
 - e. Index of refraction
 - f. Absorption
2. Specific gravity
- vii. Aspheric lenses
- viii. Atoric lenses
- ix. Multifocal lenses
 1. Types of multifocal lenses
 - a. Bifocal lenses
 - b. Trifocal lenses
 - c. Progressive addition lenses
 - d. Near variable focus lenses
 2. Determining reading power
 3. Determining intermediate power
- c. Analysis and interpretation of complex prescription
- d. Prism
 - i. Prescribed prism
 - ii. Induced prism
 1. During fabrication
 2. Determine the amount of induced prism when verifying spectacle lenses
 - iii. Prentice rule
- e. Considerations for thick lenses
- f. Addressing vertical imbalance
 - i. Calculating vertical imbalance
 - ii. Bicentric grind
- g. Complex dispensing nomenclature
- h. American National Standards Institute (A.N.S.I.) standards and complex lens anomalies
2. Skills:
 - a. Apply complex geometric formulae to lenses
 - b. Use a scientific calculator and computer
 - c. Identify the proper complex geometric formulae to correct a specific lens anomaly
 - d. Identify and correct complex lens specific errors in designing, surfacing, and dispensing
3. Issues:
 - a. Safety
 - b. Complex refractive errors
 - c. Lab breakage
 - d. Apply complex lens fabrications
 - e. Special lens materials
 - f. Occupational Safety and Health Administration enforcement of American National Standards Institute standards related to complex prescriptions

Resources

Brooks, C. (1992) *Understanding lens surfacing*, Elsevier.

Brooks, Clifford W. (2023) *System for ophthalmic dispensing*, Elsevier.

Ferguson, Roy. (2015) *Ophthalmic essentials*, National Federation of Opticianry Schools.

National Academy of Opticianry. *Ophthalmic dispensing review book*. National Academy of Opticianry, 2019.

Resources Other

1. 20/20 <https://www.2020mag.com/>
2. American Optometric Association. <https://www.aoa.org/patients-and-public/caring-for-your-vision/contact-lenses?sso=y> (<https://www.aoa.org/patients-and-public/caring-for-your-vision/contact-lenses/?sso=y>)
3. Centers for Disease Control and Prevention. "Healthy Contact Lens Wear and Care." <https://www.cdc.gov/contactlenses/index.html> (<https://www.cdc.gov/contactlenses/>)
4. Eyecare Business <https://www.eyecarebusiness.com/>
5. Invision <https://invisionmag.com/>
6. Khan Academy. <https://www.khanacademy.org/>
7. Ophthobook <https://timroot.com/ophthobook/>
8. OptiBoard Forums. <http://www.optiboard.com/forums/>
9. Quantum Optical. <http://www.quantumoptical.com/> (<https://www.2020mag.com/>)
10. Review of Optometry. <https://www.reviewofoptometry.com/>
11. Vision Professionals Board <https://vision.ohio.gov/vision-professionals/optician/3-optician> (<https://vision.ohio.gov/vision-professionals/optician/3-optician/>)

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