

# Klinische Monatsblätter für Augenheilkunde

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## Preface

In 1999 and 2000, the International Council of Ophthalmology and the Academia Ophthalmologica Internationalis developed an International Ophthalmology Strategic Plan to preserve and restore vision – Vision for the Future.

This strategic plan involved a multi pronged approach to reduce visual impairment and blindness worldwide, and the following actions have been completed or are underway to make this plan a reality:

- ▶ IFOS/ICO fellowships have been established under the leadership of Professor Balder Gloor to provide overseas educational opportunities for junior ophthalmic faculty in ophthalmology departments in developing countries.
- ▶ The International Assessment for Ophthalmologists in both clinical and basic sciences has been successfully implemented by Professor Peter Watson.
- ▶ Eye care guidelines to develop evidence-based eye care delivery, are being developed under the leadership of Professor Richard Abbott.
- ▶ Advocacy for preservation and restoration of vision to increase public awareness of blindness prevention is being headed by Professor Hugh Taylor.
- ▶ Research in ophthalmology and vision, for development of new and improved therapies for blinding diseases, is being led by Professor Alfred Sommer.

The ICO Strategic Planning Group also decided that ophthalmic education is the cornerstone to improve eye care globally. As part of this Strategic Plan, four International Task Forces were established to develop curricula for training of the ophthalmic specialist, para-ophthalmic personnel, medical students, and for continuing medical education.

After years of hard work by multiple international panels, the four curricula are being presented for publication in this issue of Klinischen Monatsblätter für Augenheilkunde as supplements.

The curricula are presented, not as mandatory standards of training or practice, but as an educational tool and consensus example to stimulate multi-levels of training including basic, standard, and advanced programs. The International Council of Ophthalmology realizes the wide variability of educational standards, patterns and prevalence of diseases, and social structures for provision of eye care in geographic regions, and therefore encourages continuous modification of these curricula according to the needs of different global communities.

Traditionally, ophthalmology residency training runs on an “Apprenticeship System” where the teaching contents and format for trainees frequently depend on the whims of the trainers. In recent decades, there is a general movement to shift the apprenticeship system of education to a curriculum-based system of

education in which goals, expectation, knowledge base, competencies and technical training are carefully defined. The four international curricula are prepared with this general direction in mind.

The panels, which drafted these curricula, understand the importance of accessibility of the educational materials and availability of mentorship. The International Task Forces encourage the donation of good teaching material to be included in these curricula and to be available for teachers and students worldwide. The ICO also proposes the twinning of training programs of industrialized and developing countries to encourage the exchange of mentors. It is recognized that competency in the practice of medicine depends on factors other than medical knowledge as outlined in these curricula. Inter-personal communication skills, professionalism, system-based factors, surgical skills, a solid ethical foundation, and others contribute substantially to the expertise and competence of eye care specialists. These curricula only provide a framework to initiate the training process.

Efficiency of eye care in the modern practice of ophthalmology depends on teamwork, consisting of ophthalmic physician specialists, ophthalmic nurses, orthoptists, optometrists, clinic managers, and others. The balance and composition of an eye care team is critical for maximum productivity of the care provided. So in these curricula, training of the eye care team is being covered.

The rapid development of medical technology in the 21<sup>st</sup> Century has resulted in greater discrepancies in the levels of medical care in various geographic locations of the world. However, the world does not work unless the world works together. These international curricula of ophthalmic education are attempts to encourage different players in the international ophthalmic educational arena to work together to develop a forward movement for improved eye care worldwide.

The International Council of Ophthalmology and the International Task Forces on Ophthalmic Education would like to thank the editors, Professors Gerhard K. Lang and Gabriele E. Lang, Project Manager, Katrin Stauffer of Klinischen Monatsblätter für Augenheilkunde, for their gracious assistance in publishing these curricula.

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# Principles and Guidelines of a Curriculum for Para-ophthalmic Vision Specialist Education

Presented by International Task Force on Para-ophthalmic Vision Specialist Education – On Behalf of The International Council of Ophthalmology (ICO)

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## Bibliography

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## I. Preamble

At a planning session for Vision for the Future organized February 24 – 27, 1999 in Egypt, the International Council of Ophthalmology and the Academia Ophthalmologica Internationalis considered ophthalmic education to be an essential part of the plan to eliminate avoidable vision loss and improve eye care worldwide. They realized the great need for the service of para-ophthalmic personnel to increase the productivity of the ophthalmic specialists, and a task force on education of para-ophthalmic vision specialists was established. Whereas training of ophthalmic specialists requires many years, para-ophthalmic personnel may be trained more expeditiously to meet urgent eye care needs in different continents. Para-ophthalmic vision specialists include optometrists, ophthalmic technologists, orthoptists, ophthalmic assistants, ophthalmic nurses, public health ophthalmic nurses, and others. Para-ophthalmic vision specialists can become a formidable bridge between the specialist service and the community in blindness prevention and eye care.

**Acknowledgement:** \*\*Past and present members of the International Task Force on Para-ophthalmic Vision Specialist Education: Sivaguru Selvarajah, FRCS, FACS, Chair (Malaysia); Rubens Belfort, MD (Brazil); Elaine Connell, MD (Australia); Daniel Etya'ale, MD (Switzerland); Thomas D. France, MD (USA); Melvin I. Freeman, MD (USA); Usha Kim, MD (India); Kazuichi Konyama, MD (Japan); Cristian Luco, MD (Chile); Thulasi Raj, MBA (India); Juan Verdaguier, MD (Chile). ICO gratefully acknowledges the edi-

## History of Task Force on Para-ophthalmic Vision Specialists

The task force was initiated under the leadership of Professors Rubens Belfort and Kazuichi Konyama. In January 2002, Professor Cristian Luco briefly took over as Chair but due to the increased workload after his appointment as Executive Director of the Pan-American Association of Ophthalmology, Professor Luco asked to be relieved of this duty. In 2004, Professor Sivaguru Selvarajah who had extensive experience in training of para-ophthalmic personnel in Malaysia, Thailand and Southeast Asia, graciously took over the responsibility as Chairman of this International Task Force.

## Special Features of the Para-ophthalmic Vision Specialist Education

1. It is recognized that the para-ophthalmic personnel may be divided into two groups. The first group of para-ophthalmic vision specialists consists of community-based personnel, who the World Health Organization (WHO) have termed as "mid-level" eye care personnel

torial efforts of Jenni Anderson and Lenalee Fulton in coordinating and assembling these curricula.

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for prevention of blindness. This group of specialists plays a critical role in eye care education, such as counseling, motivation, and follow-up care in the community. Under certain circumstances, they also provide the first line of eye care treatment and interaction with the healthcare system in the community, and referral to the primary and secondary eye care providers.

2. The second group of para-ophthalmic vision specialists are hospital-based eye care personnel with varying sophistication in refraction, ophthalmic procedures, assistance in the operating room and eye clinic, and postoperative clinical care. This group of specialists includes optometrists, ophthalmic technologists, orthoptists, ophthalmic assistants, ophthalmic nurses, and others.
3. The Training of the para-ophthalmic specialists is to be carried out in accordance with regional practices of ophthalmology and the local laws of medical practice. Medical practitioners in a regional medical center normally supervise the community-based para-ophthalmic personnel. The curriculum must be clearly defined, especially when concerned with assigned duties compatible with the local legal system.
4. It is recognized that all allied para-ophthalmic personnel must be trained and organized under one system so that there may be a unified effort of delivery of eye care. Within a unified training system, the proficiency of different levels of eye care services and number of service personnel may be carefully planned so that maximum efficiency for the team may be achieved.
5. There are several sub-specialties within the para-ophthalmic vision specialists, such as orthoptists and optometrists. Orthoptists deal with strabismus in children and adults and depending on their country of practice, have a very specific job description. As a result, a specific curriculum for orthoptists is laid out as a part of this curriculum.
6. The International Task Force decided that a curriculum for optometry would be delayed until a future date.
7. The Task Force collected available curricula from different parts of the world, including North and South America, West Africa, India, Pakistan, and the Western Pacific Region of WHO. The Task Force identified four categories of para-ophthalmic personnel for whom curricula were to be identified. Each member of the Task Force was given one category as follows:

Sivaguru Selvarajah: Community Based Para-Ophthalmic Personnel

Usha Kim: Hospital Based Para-Ophthalmic Personnel

Thomas D. France: Orthoptists

Melvin I. Freeman: Ophthalmic Technicians

Each member has produced a curriculum modified from existing curricula, and these are presented here. In using these curricula, the laws and regulations of the country in which they are used must be respected. The overlapping among curricula shows the different approaches to para-ophthalmic education. The need to identify the tasks that can be delegated, the suitable personnel to be trained, and the training needs of each particular group for any particular situation is most important.

## II. Core Curriculum For Community Based Para-ophthalmic Eye Care Personnel



This curriculum is modified from the curriculum developed by the Western Pacific Region of the World Health Organization for community based para-ophthalmic eye care workers. It consists of five modules of core curriculum, which are for the basic or standard level. The training period is one year. The entry requirement should be a graduate of a basic nursing course with some experience of work in an ophthalmic department. It is suggested that 48 weeks be devoted to theoretical work and for supervised practical training, both to run concurrently. One week will be for assessment and examinations. The remaining three weeks are for vacation breaks during the year. The five modules of the core curriculum are: Basic Community Eye Care, Basic Clinical Eye Care Functions, Basic Eye Health Care Management, Basic Training Functions, and Basic Technical Functions.

### Module 1.1: Overview of Blindness

1 week

#### I. Instructional Objectives

- A. To acquire a concept of blindness and visual impairment.
- B. To develop an understanding of the social and economic implications of blindness and quality of life of the blind.
- C. To have a knowledge of the magnitude, pattern, and distribution of blindness in the country where the curriculum will be utilized.

#### II. Subject/Topics

- A. Overview of blindness.
  1. Definition (WHO classification of low vision and blindness).
  2. Magnitude and prevalence of blindness.
    - a. At global, national, and regional levels.
      - i. Major global causes of blindness.
      - ii. Major national causes of blindness.
      - iii. Regional implications of blindness (individual, social/economical, etc.).
    - b. National Demographics.
      - i. National health indicators.
      - ii. Eye health indicators.
      - iii. Special high-risk groups.

#### III. Teaching/Methodology

- A. Lecture/Discussions.
  1. Role-playing.
  2. Audiovisuals.
  3. Student presentations.
- B. Student Assessment.
  - a. Written and oral tests.
  - b. Objective structured practical examination (OSPE).

### Module 1.2: Overview of National Health Program for Prevention of Blindness

1 week

#### I. Instructional Objective

To develop knowledge of the national programs for prevention of blindness (PBL).

#### II. Subject/Topics

- A. Orientation to Vision 2020: The Right to Sight – Global Initiative to Eliminate Avoidable Blindness.
- B. Overview of PBL and national health care programs.
- C. Structure of PBL and national health care delivery systems.
- D. Overview of PBL.

1. History of PBL (vertical and horizontal programs).
2. Team approach to PBL.
3. Structure of the national eye health care delivery system.
4. Major action plan of the national PBL

### III. Teaching/Methodology

- A. Lecture/Discussion.
- B. Student assessment.  
Written and oral tests.

## Module 1.3: The Concept of Avoidable and Unavoidable Blindness 1 week

### I. Instructional Objective

To have an understanding of the concept of avoidable and unavoidable blindness.

### II. Subject/Topics

- A. Basic concepts of comprehensive eye care.
- B. Avoidable blindness.
  1. List of conditions of avoidable blindness.
    - a. Preventable.
    - b. Curable.
  2. Concept of prevention of avoidable blindness.
- C. Unavoidable blindness.
  1. Types of blindness: corneal, lenticular, posterior segment, and undetermined.
  2. List of conditions of unavoidable blindness.

### III. Teaching/Methodology

- Lecture/Discussion.
1. Student presentations.
  2. Audiovisuals.

## Module 1.4: Primary Health Care/Primary Eye Care/Prevention of Blindness 1 week

### I. Instructional Objective

To have an understanding of the concept of primary health and primary eye care and its application in community-based programs.

### II. Subject/Topics

- A. Fundamentals of Primary Health Care (PHC).
  1. Essential elements of PHC.
- B. Basic strategies of PHC.
  1. Health education, promotion, and counseling.
- C. Fundamentals of primary eye care.
  1. Elements of primary eye care (promotive, preventive, curative, and rehabilitative).
  2. Integration of primary eye care into PHC and the establishment of an eye care network/referral system.
  3. Recording and reporting in primary eye care.

### III. Teaching/Methodology

- A. Lecture/Discussion.
- B. Student Assessment.
  - a. Written and oral tests.
  - b. OSPE.
  - c. Post-test.

## Module 1.5: Eye Health of Special Population Groups 1 week

### I. Instructional Objective

To have an understanding of programs directed at specific population groups.

### II. Subject/Topics

- Eye health of special population groups.
1. Pre-school children.
  2. School children.
  3. Industrial workers.
  4. Elderly.
  5. Low vision individuals.
  6. Others (myopics, diabetics, age-related macular degeneration).

### III. Teaching/Methodology

Lecture/Discussion.

### Reference

1. World Health Organization. Strategies for the prevention of blindness in national programs: a primary health care approach. Geneva: World Health Organization; WHO Publications Centre USA distributor; 1984:88

## Module 2.1: The Normal Eye, Common Eye Disorders and Management 10 weeks

### I. Instructional Objectives

- A. To develop adequate knowledge of the anatomy and physiology of the eye.
- B. To develop knowledge and skills to recognize and take appropriate action on common eye diseases and ocular emergencies.

### II. Subject/Topics

- A. Applied anatomy and physiology function of the eye (the normal eye).
- B. Common eye diseases and their management.
- C. Primary preventive and promoting measures for common eye diseases and ocular emergencies.

### III. Teaching/Methodology

- A. Lecture/Discussion.
- B. Demonstration.
- C. Practical session.
- D. Student assessment.
  - a. Written and oral tests.
  - b. OSPE.

## Module 2.2: Ophthalmic Clinical Skills & Nursing Care 5 weeks

### I. Instructional Objectives

- A. To develop the necessary practical skills and knowledge necessary to take the history of an eye patient, and provide visual acuity testing, and a basic eye examination.
- B. To develop the required cognitive skills, practical skills, and empathic skills necessary to perform all defined functions.

### II. Subject/Topics

- A. History taking.
- B. Visual acuity testing.
- C. Basic eye examination.
  1. Gross examination.

2. Tonometry.
3. Optional: funduscopy.

### III. Teaching/Methodology

- A. Lecture/Discussion.
- B. Demonstration.
- C. Practical session.

## Module 2.3: Development of Communication Skills 3 weeks

### I. Instructional Objectives

- A. To develop knowledge and skills to communicate effectively with individuals and the community.
- B. To promote awareness on eye health through health education.

### II. Subject/Topics

- A. Development of communication skills.
  1. Verbal and nonverbal communication.
  2. Group dynamics.
  3. Public relation strategies.
- B. Team approach.
- C. Awareness of cultural norms.
- D. Strategies on health education.

### III. Teaching/Methodology

- A. Role-playing.
- B. Poster making/pictures.
- C. Focused group discussion.
- D. Simulations.
- E. Body language exercises.
- F. Mass media messages on health education.

### References

1. Standard ophthalmology text book.
2. Friedlander MH. 20/20 A total guide to improving your vision and preventing eye disease. New York: Wing; 1991

## Module 3.1: Basic Epidemiology 2 weeks

### I. Instructional Objective

To develop basic knowledge of the principles of epidemiology in relation to eye care and its application for program management.

### II. Subject/Topics

- A. Basic Epidemiology.
  1. Principles of basic epidemiology.
    - a. Definition.
    - b. Epidemiology fundamental assumption.
    - c. Descriptive epidemiology.
    - d. Analytical epidemiology.
    - e. Experimental epidemiology.
  2. Epidemiology of ocular diseases.
    - a. Distribution of eye health problem/diseases.
    - b. Determinants of eye health problem/diseases.
    - c. Risk factors of eye health problem/diseases.
    - d. Natural history of diseases.
- B. Applications of epidemiology to eye health care management.
- C. Concept of health system research.

### III. Teaching/Methodology

- A. Lectures.
- B. Audiovisuals.

- C. Group discussions.
- D. Exercises.
- E. Student assessment.
  - a. Written and oral tests.
  - b. Continuous assessment.
  - c. OSPE.

## Module 3.2: Basic Eye Program Management 3 weeks

### I. Instructional Objectives

- A. To acquire basic knowledge and competencies for program planning, implementation, monitoring, and evaluation, including quality assurance.
- B. To demonstrate competency for eye health care management.

### II. Subject/Topics

- A. Eye Health Care management.
  1. Community health diagnosis (community demand).
  2. Eye health planning.
  3. Data collection and analysis.
  4. Monitoring and evaluation.
    - a. Input.
    - b. Process.
    - c. Outcome.
  5. Standard operating procedure for quality assurance.
  6. Information systems in eye health management, recording, reporting, and monitoring systems in eye health management.

### III. Teaching/Methodology

- A. Student assessment.
  - a. Written and oral tests.
  - b. Continuous assessment.
  - c. OSPE.

## Module 3.3: Community Resources for Health 2 weeks

### I. Instructional Objective

- A. To be able to work with community health resources and assist the community.

### II. Subject/Topics

- A. Community resources for health.
  1. Utilization of community resources.
  2. Community participation.
  3. Non-governmental organizations in prevention of blindness programs.
  4. Community financing.
  5. Volunteer system and training inter-sectoral collaboration.
- B. Screening.
  1. Principles of screening.
  2. Basic screening methodology (screening procedures).

### III. Teaching/Methodology

- A. Student assessment.
  - a. Written and oral tests.
  - b. Continuous assessment.
  - c. OSPE.

## Module 3.4: Basic Screening Methodology 3 weeks

### I. Instructional Objective

To be able to assist and participate during screening activity for ocular morbidity and blindness.



**II. Subject/Topics**

Networking and referrals.

**III. Teaching/Methodology**

- A. Student assessment.
  - a. Written and oral tests.
  - b. Continuous assessment.
  - c. OSPE.

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1. Documentation of the World Health Organization's Program for the Prevention of Blindness (WHO Headquarters Publications; WHO/PBL/91.23; Available from: URL: [www.who.int/ncd/vision2020\\_actionplan/documents/WHOPBDscanneddocuments.PDF](http://www.who.int/ncd/vision2020_actionplan/documents/WHOPBDscanneddocuments.PDF))
2. Training and educational materials for the prevention of blindness. World Health Organization (WHO Headquarters Publications), WHO/PBL/94.44; Available from URL: [www.who.int/ncd/vision2020\\_actionplan/documents/WHOPBDscanneddocuments.PDF](http://www.who.int/ncd/vision2020_actionplan/documents/WHOPBDscanneddocuments.PDF).
3. World Health Organization. Publications and documents. Health Research Methodology: A Guide for Training in Research Methods. Second Edition. Available from; URL: [www.wpro.who.int/publications/pub\\_929061157X.htm](http://www.wpro.who.int/publications/pub_929061157X.htm)

**Module 4.1: Training in Integrated Eye Care 1 week****I. Instructional Objective**

To develop the knowledge, attitude, and skills for training primary level health personnel and the community in primary eye care.

**II. Subject/Topics**

- A. Primary Eye Care Training Course.
- B. Strategies in training.
- C. Teaching methodology.

**III. Teaching/Methodology**

- Lecture/Discussion.
1. Role-play.
  2. Audiovisuals.
  3. Student presentations.
  4. Case studies.

**Module 4.2: Training Process 2 weeks****I. Instructional Objective**

To develop knowledge, attitude, and skill in the training process.

**II. Subject/Topics**

- Training Process.
1. Who are the students?
  2. What are they able to do before the training?
  3. What should they be able to do after the training?
  4. What behavioral changes should the course bring about?
  5. What will be done to bring these changes?
  6. How can these changes be observed and assessed?

**III. Teaching/Methodology**

- Student assessment.
- a. Written and oral tests.
  - b. Continuous assessment.
  - c. OSPE.

**Module 4.3: Assessment of Needs 1 week****I. Instructional Objective**

To develop knowledge, attitude, and skill in the ways of assessing needs of a training course.

**II. Subject/Topics**

- Assessment of needs.
1. Interviews.
  2. Questionnaire.
  3. Group discussions.
  4. Written tests/Practical tests.

**III. Teaching/Methodology**

- Lecture/Discussion.
1. Role-play.
  2. Audiovisuals.
  3. Student presentations.
  4. Case studies.

**Module 4.4: Setting Objectives of the Course 1 week****I. Instructional Objective**

To develop knowledge, attitude, and skill in designing a training course.

**II. Subject/Topics**

- A. What should the student be able to do after the course?
- B. What objectives are derived from required tasks of the job?
- C. What objectives specify the knowledge, empathy, and skills that the student must learn?
- D. Designing the course.

**III. Teaching/Methodology**

- Lecture/Discussion.
1. Role-play.
  2. Audiovisuals.
  3. Student presentations.
  4. Case studies.

**Module 4.5: Designing the Course 1 week****I. Instructional Objective**

To develop knowledge, attitude, and skill in designing a training course.

**II. Subject/Topics**

- How to achieve objectives.
1. When, where, to whom, and what will be done to achieve objectives.
  2. Lectures, demonstrations, discussions.
  3. Exercises, role-playing, projects.
  4. Field trips and observations.
  5. Self-instructional materials.

**III. Teaching/Methodology**

- Lecture/Discussion.
1. Role-play.
  2. Audiovisuals.
  3. Student presentations.
  4. Case studies.

**Module 4.6: Evaluation of the Course 1 week****I. Instructional Objective**

To develop knowledge, ability, and skill to evaluate the course.

**II. Subject/Topics**

- A. Assessment of knowledge: written and oral tests.
- B. Assessment of ability: observations, role-playing, logbooks, and diaries.
- C. Assessment of skills: checklists, rating scales, observation of actual performance, and practical tests.

**III. Teaching/Methodology**

Lecture/Discussion.

1. Role-play.
2. Audiovisuals.
3. Student presentations.
4. Case studies.

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1. Teaching for Better Learning. A Guide for Teachers of Primary Health Care Staff. World Health Organization, 2nd edition. Available from; URL: [www.who.int/bookorders/anglais/depart1.jsp?sesslan=1&codlan=1&codcol=15&codcch=377](http://www.who.int/bookorders/anglais/depart1.jsp?sesslan=1&codlan=1&codcol=15&codcch=377)
2. Ewan, C. Teaching skills development manual. Geneva: World Health Organization; 1982
3. Gagne RM. Essentials of learning for instruction. Chicago: The Dryden Press; 1974

**Module 5.1: Basic Eye Equipment and Maintenance****4 weeks****I. Instructional Objective**

To develop the knowledge, attitude, and skills necessary for care, maintenance, and minor repair of ophthalmic equipment and instruments.

**II. Subject/Topics**

- A. General aspects of basic eye equipment and their use.
- B. Ophthalmic surgical instruments.
- C. Standard cleaning procedures for ophthalmic equipment and instruments.
- D. Preventive maintenance and minor repair of eye equipment and instruments.

**III. Teaching/Methodology**

- A. Lecture/Discussion.
- B. Demonstration.
- C. Practical session.
- D. Audiovisuals.
- E. Student assessment.
  1. Return demonstration checklist.
  2. Written and practical examinations.

**Module 5.2: Asepsis and Sterilization****4 weeks****I. Instructional Objective**

To develop knowledge, attitude, and skill in aseptic techniques.

**II. Subject/Topics**

- A. Asepsis and sterilization.
  1. Basic microbiology.
  2. Role of microbes in the transmission of diseases.
  3. Definition of disinfection and sterilization.
- B. Common sterilization techniques.
  1. Advantages and disadvantages.
  2. Effective hand washing and scrubbing techniques.
  3. Sterilization of instruments.

**III. Teaching/Methodology**

- A. Lecture/Discussion.
- B. Demonstration.
- C. Practical session.

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1. Stein HA, Stein RM, Freeman MI. The ophthalmic assistant: a text for allied and associated ophthalmic personnel. 8th ed. Philadelphia: Elsevier Mosby; 2006: xviii, 871
2. (No authors listed). The care and handling of surgical instruments. St. Louis: Storz Co.; 1991

**III. Advanced Curriculum for Community Based Para-ophthalmic Eye Care Personnel**

An advanced curriculum was developed for further training of chosen candidates who successfully completed the core curriculum, and then spent a variable period of time at their home base. This advanced training course is one year. Candidates who successfully complete the advanced training course can become course instructors.

The advanced curriculum consists of an orientation module and advanced courses in eye health care management, visual function skills, and ophthalmic technology.

**Module 1.1: Refraction****4 weeks****I. Instructional Objectives**

- A. To know the basic concepts about vision.
- B. To learn the different types of refractive error and their proper correction.
- C. To perform simple refraction and be able to prescribe corrective lenses.

**II. Subject/Topics**

- A. Basic concepts.
  1. Human eye as an optical system.
  2. Visual acuity with pinhole.
  3. Meaning of 20/20.
  4. Accommodation.
- B. Types of refractive error.
  1. Ametropia: myopia, hyperopia, and astigmatism.
  2. Presbyopia.
  3. How to correct refractive errors.
    - a. Spherical and cylindrical lenses.
- C. Measuring the refractive errors.
  1. Subjective vs. objective method.
  2. Subjective refraction: fogging, astigmatic dial.
  3. Objective refraction.
    - a. Principle of cycloplegia refraction.
    - b. Manifest refraction: retinoscopy.
    - c. Technique of retinoscopy.
- D. How to prescribe glasses.
  1. Subjective vs. objective.
  2. Adds for presbyopia.
  3. Measuring pupillary distance.
  4. Writing prescriptions.
- E. Indications for referral.
 

Any condition needing further attention.

**III. Teaching/Methodology**

Written and oral tests.



**Module 1.2: Ocular Motility, Strabismus, Amblyopia**

4 weeks

**I. Instructional Objectives**

- A. To understand orthoptics purpose and significance.
- B. To assist in the assessment of binocular function and extraocular muscle dysfunction.

**II. Subject/Topics**

- A. Development of visual function and critical periods in childhood.
- B. Principles of binocular function.
- C. Principles in the assessment of binocular function.
- D. Orthoptics.
  1. Orthoptics and pleoptics.
  2. Strabismus/amblyopia.
  3. Definition.
  4. Basic screening techniques for strabismus/amblyopia.
  5. Principles of management of strabismus and amblyopia, and indications for referral.

**III. Teaching/Methodology**

Written and oral tests.

**Module 1.3: Low Vision**

4 weeks

**I. Instructional Objectives**

- A. To be able to screen for possible low vision patients.
- B. To assist in the assessment and provision of low vision care for patients.
- C. To be able to teach primary level low vision rehabilitation techniques.

**II. Subject/Topics**

- A. Definition of low vision.
- B. Psychological implications of low vision.
- C. Principles of functional assessment in low vision.
- D. Concepts of community-based rehabilitation.
- E. Problem-solving skills.
  1. Environmental modifications.
  2. Adaptive daily living skills.
  3. Non-optical devices.
  4. Sighted guide.
- F. Overview of low vision devices.
- G. Indications for referral.

**III. Teaching/Methodology**

Written and oral tests.

**Module C1.1: Epidemiology**

3 weeks

**I. Instructional Objectives**

- A. To assist in the management of a screening and referral system for blindness.
- B. Case management development ability.

**II. Subject/Topics**

- Screening Methodology.
1. Principles of screening.
  2. Screening method: sampling.
    - a. Random.
    - b. Stratified.
    - c. Systemic.
    - d. Cluster.
  3. Validity: sensitivity and specificity.
  4. Cost benefit effect: networking and referrals.

5. Distribution of hospitals and clinics in the community.
6. Building consensus.
7. Referral standards case management.
8. Follow-up procedures.
9. Environmental assessment and protection.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.
- C. Discussion.
- D. Demonstrations.
- E. Student assessment.
 

Written and oral tests.

**Module C1.2: Health Systems Research**

3 weeks

**I. Instructional Objective**

To participate in health systems research.

**II. Subject/Topics**

- Research methodologies.
1. Non-intervention study.
  2. Intervention study.
  3. Bias in sampling: selection bias, information bias, and confounding principles of health system research.
    - a. Literature review.
    - b. Questionnaire design.
    - c. Basic statistics.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.
- C. Discussion.
- D. Demonstrations.
- E. Student assessment.
 

Written and oral tests.

**Module C1.3: Training Function**

3 weeks

**I. Instructional Objective**

To conduct training programs for instructors.

**II. Subject/Topics**

- A. Assessment of training needs for instructors.
  1. Design of instructional plan.
  2. Implementation of instructional plan.
  3. Instructional aids.
  4. Evaluation of training course.
- B. Concept of learning and principles of teaching instructional methodologies.
- C. Characteristics of adult learning.
- D. Competency of effective teachers.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.
- C. Discussion.
- D. Demonstrations.
- E. Student assessment.
 

Written and oral tests.

**Module C1.4: Primary Health Care and Primary Eye Care**

3 weeks

**I. Instructional Objective**

To acquire additional knowledge of primary health care and primary eye care concepts.

**II. Subject/Topics**

- A. Strategies on the integration of primary eye care into primary health care.
- B. Dynamics of eye care.
- C. Eye information system support for prevention of blindness.
- D. Program monitoring and evaluation.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.
- C. Discussion.
- D. Demonstrations.

**Module C2.1: Caring for the Blind****1 week****I. Instructional Objectives**

- A. To understand the multiple factors (physical, psychological, social, and spiritual) that affect blind people.
- B. To understand the role of the family and community in the rehabilitation of the blind.

**II. Subject/Topics**

- A. Preparing the blind and family for rehabilitation.
- B. Environmental barriers in rehabilitation of the blind.
- C. Training home-helpers for the blind.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.
- C. Discussion.
- D. Demonstrations.
- E. Student assessment.
  1. Written and oral tests.
  2. Continuous assessment.
  3. OSPE.

**Module C2.2: Rehabilitation of the Blind****2 weeks****I. Instructional Objectives**

- A. To assist in the referral and/or training of the blind to enable self-reliance.
- B. To become familiar with the overall process of rehabilitation of the blind.

**II. Subject/Topics**

- A. Principles in the rehabilitation of the blind.
- B. Stages in rehabilitation of the blind.
  1. Activities for daily living.
  2. Socialization training (Braille, sports, etc.).
  3. Resources for the blind.
  4. Vocational training.

**III. Teaching/Methodology**

- A. Performance checklist.
- B. Discussions.
- C. Lectures.
- D. Tutorials.
- E. Visit school for the blind.

**Module C2.3: Refraction****7 weeks****I. Instructional Objectives**

- A. To perform advanced refraction and be able to prescribe corrective lenses.
- B. To know the different options for correct refractive errors.

- C. To learn the special considerations involved in correction and prescription.

**II. Subject/Topics****A. Advanced techniques in refraction.**

1. Review of retinoscopy.
2. Cycloplegic refraction.
3. Cross cylinder technique.
4. Duo chrome test.
5. Auto-refractors.
6. Determination of cylinder axis and power.
7. Cutting the cylinder and the spherical equivalent.
8. Transposition while prescribing (plus toric vs. minus toric).

**B. Options for correcting refractive errors.**

1. Glasses (spectacles).
  - a. Far point correction.
  - b. Effect of accommodation.
  - c. Partial vs. full correction.
2. Contact lenses (hard contact lens, soft contact lens, rigid gas permeable lens).
  - a. Types: toric, disposable, extended wear.
  - b. Lens fitting.
  - c. Patient selection.
  - d. Complications.
3. Surgery – RK, PRK, LASIK.
  - a. Preoperative evaluation: keratometry, pachymetry, topography.
  - b. Procedure.
  - c. Complication.

**III. Teaching/Methodology**

- A. Written and oral tests.
- B. Practical.
- C. Tests.
- D. OSPE.
- E. Discussions.
- F. Lectures.
- G. Tutorials.
- H. Visit school for the blind.
- I. Demonstration.
- J. Practical sessions.

**Module C2.4: Low Vision****3 weeks****I. Instructional Objective**

- To assist in the assessment and rehabilitation of low vision patients in the institution.

**II. Subject/Topics**

- A. Special considerations for correction.
  1. Strabismus.
  2. Refraction after cataract surgery – pseudophakia, aphakia.
  3. Anisometropia.
- B. Psychological support for low vision patients.
- C. Planning of goals for low vision services.
- D. Overview of adjunctive lenses and other optical low vision devices.
  1. Elementary skills for fitting optical low vision devices.
  2. Elementary skills for fitting optical low vision aids.
- E. Planning for public awareness.
- F. Community resources for low vision.
- G. Follow-up of low vision patients.
- H. Special population with low vision.

**III. Teaching/Methodology**

- A. Discussions.
- B. Lectures.
- C. Tutorials.
- D. Visit school for the blind.
- E. Demonstration.
- F. Practical sessions.

**Module C2.5: Orthoptics****3 weeks****I. Instructional Objective**

To assist in the assessment and management or rehabilitation of binocular dysfunction and extraocular muscle problems in the institution.

**II. Subject/Topics**

- A. Amblyopia and its management.
  - 1. Causes of amblyopia.
  - 2. Types of amblyopia.
    - a. Strabismic amblyopia.
    - b. Amblyopia with straight eyes.
    - c. Anisometropic amblyopia.
  - 3. Treatment modalities.
    - a. Glasses, occlusion, training.
  - 4. Prevention of recurrence.
- B. Strabismus and its management.
- C. Follow-up of patients with strabismus/amblyopia.
- D. Special populations with strabismus.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.
- C. Practical sessions.

**Module C3.1: Pharmacology****4 weeks****I. Instructional Objectives**

- A. To properly dispense specific topical eye drops.
- B. To prepare specific topical eye drops from commercially available preparations or raw materials.
- C. To instruct patient on proper eye medication application.

**II. Subject/Topics**

- A. Pharmacology of topical eye preparations.
  - 1. Steroids/NSAIDs.
  - 2. Anesthetics.
  - 3. Antimicrobial.
  - 4. Mydriatics, cycloplegics.
  - 5. Miotics/beta-blockers.
  - 6. Fluorescein dye/rose bengal stain.
- B. Classification of diagnostic and therapeutic agents.
- C. Side effects of eye drops and eye ointment.
  - 1. Local and systemic.
- D. Principles of preparation of local topical eye drops.
  - 1. Good manufacturing procedures.
  - 2. Laws and regulations for safe sterilization of eye medication.
- E. Record keeping for eye medications.
- F. Eye medications.
  - 1. Application of topical eye drops and eye ointment.
  - 2. Subconjunctival injection.
  - 3. Periorbital injection.

**III. Teaching/Methodology**

- A. Lectures.
- B. Tutorials.

C. Discussion.

D. Demonstration

E. Student assessment.

Written and oral tests.

**Module C3.2: Minor Surgery****3 weeks****I. Instructional Objective**

To perform or assist in various minor ophthalmic surgical procedures.

**II. Subject/Topics**

- A. Minor surgery.
  - 1. Incision & curettage (chalazion).
  - 2. Epilation (for trichiasis).
  - 3. Trachoma lid procedures.
  - 4. Removal of superficial corneal and conjunctival foreign bodies.
- B. Administration of topical and infiltration (local) anaesthesia.

**III. Teaching/Methodology**

- A. Written and oral tests.
- B. Test performance.
- C. Lectures.
- D. Tutorials.
- E. Discussion.
- F. Demonstration.
- G. Practical demonstration.

**Module C3.3: Diagnostic Procedures****3 weeks****I. Instructional Objective**

To perform or assist in specialized diagnostic procedures and some specialized therapeutic procedures.

**II. Subject/Topics**

- A. Specialized diagnostic procedures.
  - 1. Keratometry.
  - 2. Tonometry.
  - 3. Perimetry.
  - 4. Strabismus evaluation.
  - 5. Biometry/A-scan.
  - 6. B-scan ultrasound.
  - 7. Fundus photography.
  - 8. Electrophysiologic tests.
  - 9. (VEP, ERG, EOG).
  - 10. Use of synoptophore.
  - 11. Assist in
    - a. Fluorescein angiography.
    - b. Laser therapy.

**III. Teaching/Methodology**

- A. Written and oral tests.
- B. Test performance.
- C. Test.
- D. Performance.
- E. Check list.
- F. Lectures.
- G. Tutorials.
- H. Discussion.
- I. Demonstration.
- J. Visit to eye bank.

**Module C3.4: Eye Banking**

2 weeks

**I. Instructional Objectives**

- A. To be knowledgeable in the fundamentals of an eye bank and eye banking.
- B. To be able to assist in the procurement, quality control, serological tests, and distribution of corneal tissue.

**II. Subject/Topics**

- A. Eye bank management.
  1. Setting up an eye bank.
  2. Eye bank operation.

**III. Teaching/Methodology**

- A. Demonstration.
- B. Checklist.

**Module C3.5: Microbiology**

2 weeks

**I. Instructional Objectives**

- A. To be able to assist in eye bank management.
- B. To develop skills in getting specimens from ocular tissues for simple microbiological examination.
- C. To be able to perform some simple microbiological procedures.

**II. Subject/Topics**

- A. Specimen taking methodology and processing microbiology.
  1. Principles of diagnostic ocular microbiology.
  2. Gram/Giemsa staining.
  3. Ocular cytology.

**III. Teaching/Methodology**

- A. Lecture/Discussion.
- B. Demonstration.
- C. Practical sessions.

**Module C3.6: Spectacles and Low Vision Devices**

2 weeks

**I. Instructional Objective**

To learn how low cost spectacles, low vision devices, and IOLs can be produced.

**II. Subject/Topics**

- A. Low cost vision devices.
  1. Simple corrective lenses.
  2. Aphakic lens.
  3. Intraocular lens implants.
  4. Spectacles for low vision.
- B. Use of donated glasses.

**III. Teaching/Methodology**

- A. Lecture/Discussion.
- B. Demonstration.
- C. Practical sessions.

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1. Trobe JD, American Academy of Family Physicians. The physician's guide to eye care. 2nd ed. San Francisco: Foundation of the American Academy of Ophthalmology; 2001:xi, 228
2. The "Atlas of Ophthalmology" (<http://www.atlasophthalmology.com>) is an online multimedia database edited by Georg Michelson, MD, from the University Augenklinik in Erlangen, Germany and Robert Machemer, MD, from Duke University in Durham, North Carolina, USA. It is endorsed by the ICO.

**IV. Curriculum For Hospital Based Para-ophthalmic Personnel**

Mid level ophthalmic personnel (MLOP) are proving to be a critical human resource in eye care delivery in the areas of outpatient and inpatient care, as well as in the operating room. The set of activities performed by MLOPs are a mix of patient care, use and maintenance of advanced equipment, documentation, maintenance of medical records, patient education, and counseling.

Mid level ophthalmic personnel should be trained with knowledge and skills to assist the ophthalmologist in various eye care activities. They should be able to perform duties assigned by the ophthalmologist. However, MLOPs are not to be certified as independent practitioners.

A structured training for MLOPs with a standard curriculum and evaluation, considerably enhance the quality of eye care services and significantly increase the number of patients served. The first step in the curriculum design is to conceptualize the roles and functions of this cadre of personnel, given the understanding that they will be working in a hospital setting under an ophthalmologist. The following are identified as the job description:

**Overall Responsibilities**

1. To assist the ophthalmologist in various eye care activities.
2. To perform duties assigned by the ophthalmologist.
3. To generate important information to be used for diagnosis or treatment (but not to generate medical or surgical diagnosis or prescriptions).

**Specific Responsibilities**

1. History taking.
2. Vision checking.
3. Refraction.
4. Color vision testing.
5. Vital parameters.
6. Asepsis and sterilization.
7. Assisting in ophthalmic surgeries.
8. First aid and assistance in ocular emergencies.
9. Maintenance of ophthalmic instruments and equipment.
10. Preoperative and postoperative patient care.
11. Record keeping.
12. Counseling.
13. Community out-reach work.

**The Course**

The curriculum is covered over a period of two years and is designed to equip the candidates with the required cognitive skills, practical skills, and empathic skills necessary to perform the above-defined functions. The course is full-time and on-the-job with 70% of time spent on skills development. The medium of instruction is in the local language.

**Selection of Trainees**

Selection of trainees should be based on the following criteria:

1. Age: 17 – 25.
2. Education: Passed higher secondary exams or equivalent, preferably with a science background.
3. Transparency in selection based on merit/entrance test, interview.

**Detailed Syllabus****Curriculum for Hospital-based Para-ophthalmic****Personnel****SEMESTER 1****I. Orientation to Medical Ethics, Professional Behavior, Medical and Ophthalmic Terminologies**

- A. Instructional Objectives.
  1. To acquire a concept of medical ethics and professional behavior.
  2. To understand the importance of ophthalmic assistants.
  3. To develop required qualities.
  4. To become familiar with medical terminologies.
- B. Subject/Topics.
  1. Importance of ophthalmic assistants and required qualities.
  2. Medical ethics.
  3. Professional behavior and qualities required.
  4. Medical terminology.
  5. Ophthalmic terminology.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
  2. Audiovisuals.

**II. Human Anatomy and Physiology – Introduction**

- A. Instructional Objectives.
  1. To acquire a knowledge of the anatomy and physiology of various systems of the human body.
  2. To develop skills for measurement and recording of blood pressure, pulse, temperature and respiratory rate.
- B. Subject/Topics.
  1. Digestive System.
  2. Excretory System.
  3. Respiratory System.
  4. Cardiovascular System.
  5. Musculoskeletal System.
  6. Sensory System.
  7. Endocrine System.
  8. Reproductive System.
  9. Nervous System.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
  2. Practical session.

Measurement and recording of:

- a. Blood pressure.
- b. Pulse.
- c. Temperature.
- d. Respiratory rate.

3. Student assessment.

Written and oral tests.

**III. Ocular Anatomy and Physiology**

- A. Instructional Objective.
  1. To acquire a knowledge of ocular anatomy and physiology.
- B. Subject/Topics.
 

Anatomy and Physiology of:

  1. Lids and glands.
  2. Lacrimal apparatus.
  3. Conjunctiva.
  4. Cornea and sclera.
  5. Lens.
  6. Retina and vitreous.
  7. Uvea.
  8. Extraocular muscles.
  9. Circulation of the eye.
  10. Visual pathways.
  11. Cranial nerves III, IV, V, VI, and VII.
  12. Aqueous humor.
  13. Light reflex, convergence, and accommodation.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
  2. Audiovisuals.
  3. Student assessment.

Written and oral tests.

**IV. Introduction to Ophthalmic Instruments & Equipment**

- A. Instructional Objectives.
  1. To acquire a knowledge of ophthalmic instruments and equipment.
  2. To develop skills for usage of ophthalmic instruments and equipment.
- B. Subject/Topics.
 

Ophthalmic instruments and equipment:

  1. Trial sets and frames.
  2. Tonometer.
  3. Slit lamp.
  4. Perimeter.
  5. Keratometer.
  6. Lensometer.
  7. A-scan.
  8. Surgical microscope.
  9. Autoclave machines.
- C. Teaching/Methodology.
  1. Lecture/Discussion.
  2. Practical session.
  3. Demonstration of use of ophthalmic instruments and equipment.

**V. Orientation to Ward, Outpatient Department and Operation Room**

- A. Instructional Objective.
  1. To acquire an orientation to the inpatient ward, outpatient department (OPD), and operating room.
- B. Subject/Topics.
 

Introduction to:

  1. Inpatient ward.

2. Outpatient department.
3. Operating room.
- C. Teaching/Methodology.
  1. Lecture/Discussion.
  2. Practical session.

#### VI. Optics and Refraction

- A. Instructional Objectives.
  1. To develop knowledge of optics and refraction.
  2. To develop skills for vision testing and recording lens power.
- B. Subject/Topics.
  1. Introduction to light.
  2. Reflection and refraction.
  3. Refractive errors.
  4. Optics of refractive errors.
  5. Eye as an optical instrument.
  6. Lenses and their combinations.
  7. Optical aberrations of the eye.
- C. Teaching/Methodology.
  1. Lecture/Discussion.
  2. Practical session.
 

Measurement and recording:

    - a. Visual acuity.
    - b. Lens powers.

#### VII. Inter-personal Relationships

- A. Instructional Objective.
  1. To develop an understanding of inter-personal relationships and its importance.
- B. Subject/Topics.
 

Fundamentals of Inter-personal relationships:

  1. Empathy and values.
  2. Personality and temperaments.
  3. Motivation.
  4. Work tolerance.
  5. Team work and being a team player.
  6. Leadership qualities.
  7. Delegation of responsibilities.
  8. Risk-taking.
  9. Communication skills.
  10. Functional English.
- C. Teaching/Methodology.
  1. Lecture/Discussion.
  2. Role-playing.
  3. Focused group discussion.

#### VIII. Orientation to Common Eye Diseases

- A. Instructional Objectives.
  1. To acquire a knowledge of common eye diseases.
  2. To develop skills for recording intraocular pressure and lacrimal system patency.
- B. Subject/Topics.
 

Common eye diseases:

  1. Common lid abnormalities: stye, chalazion, ptosis, blepharitis, ectropion, entropion, trichiasis.
  2. Conjunctiva: conjunctivitis, red eye, pterygium, pinguecula, foreign body.
  3. Cornea: foreign body, epithelial defects, ulcer, scars.
  4. Lens: cataract.
  5. Glaucoma.
  6. Uveitis.
  7. Vitamin A deficiency.
- C. Teaching/Methodology.
  1. Lecture/Discussions.

2. Audiovisuals.
3. Practical session.
  - a. Examination of the eye using a penlight.
  - b. Measurement and recording of:
    - i. Intraocular pressure using tonometry.
    - ii. Lacrimal duct patency – syringing.
4. Student assessment.
 

Written and oral tests.

#### IX. Pharmacology

- A. Instructional Objectives.
  1. To acquire necessary knowledge of ocular medications.
  2. To develop necessary skills in usage of ocular medications.
  3. To have a knowledge of prescription writing.
- B. Subject/Topics.
 

Commonly used ocular drugs:

  1. Mydriatics.
  2. Miotics.
  3. Antibiotics.
  4. Antifungals.
  5. Antivirals.
  6. Anti-glaucoma.
  7. Diagnostic agents.
  8. Anesthetics.
  9. Steroids.
  10. Anti-allergy.
  11. Non steroidal anti-inflammatory drugs.
  12. Routes of administration.
  13. Prescriptions.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
 

Audiovisuals.
  2. Practical session.
    - a. Instill eye drops.
    - b. Irrigation of the eye.
  3. Student assessment.
 

Written and oral tests.

#### X. Microbiology

- A. Instructional Objectives.
  1. To acquire necessary knowledge of various micro-organisms.
  2. To develop knowledge and skills in maintenance of asepsis and sterilization.
- B. Subject/Topics.
  1. Bacteria, virus, fungus.
  2. Asepsis and sterilization.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
  2. Audiovisuals.
  3. Practical session.
  4. Student assessment.
 

Written and oral tests.

#### XI. Biochemistry

- A. Instructional Objective.
 

To acquire knowledge about various biochemical investigations relevant to ophthalmology.
- B. Subject/Topics.
 

Biochemical investigations relevant to ophthalmology.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
  2. Audiovisuals.



**XII. Common Medical and Ophthalmic Emergencies**

- A. Instructional Objective.  
To acquire knowledge about common medical and ophthalmic emergencies.
- B. Subject/Topics.
1. Vasovagal attack.
  2. Hypoglycemia.
  3. Foreign body.
  4. Chemical injury.
  5. Ocular trauma.
  6. Acute visual loss.
- C. Teaching/Methodology.
1. Lecture/Discussions.
  2. Audiovisuals.
  3. Focused group discussion.

**XIII. Community Ophthalmology**

- A. Instructional Objectives.
1. To acquire knowledge about the various components of Community Ophthalmology.
  2. To have an understanding of the National Eye Care Programs and Vision 2020.
  3. To acquire knowledge of diseases of the eye related to industrial hazards and nutrition.
- B. Subject/Topics.
1. School screening.
  2. Community-based rehabilitation.
  3. Community eye care.
  4. Magnitude of blindness.
  5. National Eye Care Programs & Vision 2020.
  6. Industrial hazards.
  7. Nutrition and eye diseases.
- C. Teaching/Methodology.
1. Lecture/Discussions.
  2. Audiovisuals.
  3. Focused group discussion.
  4. Student assessment.  
Written and oral tests.

**XIV. Semester I: Exit Competencies**

1. Will be able to receive patients.
2. Measure visual acuity.
3. Check vital parameters.
4. Check for lacrimal patency.
5. Perform tonometry.
6. Instill drops in the eye.

**Curriculum for Hospital-based Para-ophthalmic Personnel SEMESTER 2****I. Refraction**

- A. Instructional Objectives.
1. To acquire knowledge of refraction and refractive errors.
  2. To acquire skills in performing retinoscopy.
- B. Subject/Topics.
1. Retinoscopy.
  2. Subjective refraction.
  3. Myopia.
  4. Hypermetropia.
  5. Astigmatism.
  6. Aphakia.
  7. Pseudophakia.
  8. Muscle balance.

9. Binocular single vision.
10. Anisometropia & aniseikonia.
11. Accommodation and convergence.
12. Phorias.
13. Tropias.
14. Amblyopia.
15. Nystagmus.

**C. Teaching/Methodology.**

1. Lecture/Discussions.
2. Audiovisuals.
3. Practical session.  
Perform retinoscopy:
  - a. Myopia.
  - b. Hypermetropia.
  - c. Astigmatism.
  - d. Aphakia.

**II. Common Eye Disorders**

- A. Instructional Objective.  
To acquire knowledge of common eye disorders and their identification.
- B. Subject/Topics.  
Common eye disorders.
1. Lids.
  2. Lacrimal apparatus.
  3. Orbit.
  4. Conjunctiva, limbus.
  5. Cornea, sclera.
  6. Uvea.
  7. Glaucoma.
  8. Lens.
  9. Retina.
  10. Trauma.
- C. Teaching/Methodology.
1. Lecture/Discussions.
  2. Audiovisuals.
  3. Practical session.
    - a. Examination of the eye using a penlight.
    - b. Identification of common eye diseases.

**III. Outpatient Department (OPD) Instruments**

- A. Instructional Objectives.
1. To acquire knowledge of OPD instruments.
  2. To develop skills for usage of OPD instruments.
- B. Subject/Topics.
1. Synaptophore.
  2. RAF ruler.
  3. Maddox rod.
  4. Maddox wing.
- C. Teaching/Methodology.
1. Lecture/Discussions.
  2. Audiovisuals.
  3. Practical session.
    - a. Use of instruments:
      - i. RAF ruler.
      - ii. Maddox rod and wing.
      - iii. Synaptophore.
    - b. Cover/uncover test.

**IV. Data Entry and Maintenance of Medical Records**

- A. Instructional Objective.  
To acquire knowledge of data entry and maintenance of medical records.
- B. Subject/Topics.
1. Data entry.

2. Maintenance of medical records.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
    - a. Data entry.
    - b. Medical record maintenance.
- V. **Principles of Sterilization and Asepsis**
  - A. Instructional Objective.
 

To acquire knowledge of sterilization and asepsis.
  - B. Subject/Topics.
    1. Waste disposal.
    2. Handling of sterile supplies.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
      - a. Waste disposal.
      - b. Handling sterile supplies.
      - c. Handling sutures, intraocular lenses.
    2. Practical session.
- VI. **Surgical instruments**
  - A. Instructional Objective.
 

To acquire knowledge of instruments required in various ocular surgeries.
  - B. Subject/Topics.
 

Instruments required in the following surgeries.:

    1. Cataract.
    2. Minor procedures.
    3. Glaucoma.
    4. Dacryocystectomy, dacryocystorhinostomy.
    5. Others.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- VII. **Surgical Equipment**
  - A. Instructional Objective.
 

To acquire knowledge of equipment required in ophthalmic surgeries.
  - B. Subject/Topics.
    1. Operating light.
    2. Microscope.
    3. Cautery.
    4. Others.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- VIII. **Concepts of Scrubbing, Gowning, and Gloving**
  - A. Instructional Objective.
 

To acquire knowledge of the concepts of scrubbing, gowning, and gloving.
  - B. Subject/Topics.
 

Techniques of:

    1. Surgical prepping and draping.
    2. Gowning and gloving.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
      - a. Scrubbing, gloving, prepping, and draping.
      - b. Circulating in the operating room.
- IX. **Preoperative Assessment and Counseling**
  - A. Instructional Objectives.
    1. To acquire necessary knowledge in preoperative assessment, anesthesia, and surgery-related complications.
    2. To acquire counseling knowledge and skills.
  - B. Subject/Topics.
    1. Techniques of local and regional anesthesia.
    2. Cataract complications.
    2. Intraoperative complications.
    3. Postoperative complications.
    4. Preoperative counseling.
    5. Postoperative counseling.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
      - a. Local and regional blocks.
      - b. Preoperative and postoperative counseling.
    2. Practical session.
    3. Focused group discussions.
- X. **History Taking and Examination of the Eye**
  - A. Instructional Objectives.
    1. To acquire knowledge in History Taking and Examination of the Eye.
  - B. Subject/Topics.
    1. History taking and recording.
    2. Examination of the eye.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
    3. Focused group discussions.
- XI. **Eye Camp Set Up**
  - A. Instructional Objective.
    1. To develop knowledge for set up of an eye camp.
  - B. Subject/Topics.
    1. Orientation for set up of an eye camp.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
      - a. Participating in various areas of the eye camp
    3. Focused group discussions.
- XII. **Semester 2: Exit Competencies**
  1. Will be able to examine the eye.
  2. Enter data.
  3. Perform retinoscopy in simple cases.
  4. Sterilize instruments, equipment, and operating room.
  5. Handle sterile instruments.

## Curriculum for Hospital-based Para-ophthalmic Personnel

### SEMESTER 3

- I. **Patient Examination**
  - A. Instructional Objective.
    1. To acquire necessary knowledge in patient examination.
  - B. Subject/Topics.
    1. Color vision.
    2. Visual fields.
    3. Ocular motility.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- II. **Lenses and Refractive Surgery**
  - A. Instructional Objective.
    1. To acquire necessary knowledge of different types of lenses and refractive surgeries.
  - B. Subject/Topics.
    1. Different types of lenses.

- a. Oblique cylinder.
- b. Transposition.
- c. Contact lenses.
- 2. Refractive surgery.
- C. Teaching/Methodology.
  1. Lecture/Discussions.
  2. Practical session.
- III. Introduction to Computers**
  - A. Instructional Objective.
 

To acquire necessary knowledge of computers.
  - B. Subject/Topics.
 

Introduction to computers.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- IV. Ocular and Systemic Emergencies**
  - A. Instructional Objectives.
    1. To acquire knowledge of ocular and systemic emergencies.
    2. To identify and act on emergencies.
  - B. Subject/Topics.
    1. Ocular and systemic emergencies.
    2. Preventable emergencies.
    3. What requires immediate review by an ophthalmologist.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- V. Overview of Blindness**
  - A. Instructional Objectives.
    1. To acquire a concept of blindness and visual impairment.
    2. To develop knowledge of the national programs for the prevention of blindness.
  - B. Subject/Topics.
    1. Causes of visual impairment and blindness.
    2. National programs for blindness control.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- VI. Eye Camp**
  - A. Instructional Objective.
    1. To acquire knowledge of functioning of an eye camp and guidelines for conducting eye camps.
  - B. Subject/Topics.
    1. Functioning of an eye camp.
    2. Guidelines for conducting eye camps.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
- VII. Patient Examination and Surgical Assistance**
  - A. Instructional Objectives.
    1. To acquire knowledge in patient examination.
    2. To develop knowledge in assisting ocular surgeries.
  - B. Subject/Topics.
    1. Evaluation of color vision, visual field, and ocular motility.
    2. Contact lens and corneal ulcers, staining and scraping.
    3. Use of computers.
    4. Assisting in ocular surgeries for:
      - a. Cataract management.
      - i. Different surgical types.
      - ii. Instruments and equipment required for various techniques.
    - b. Glaucoma management.
    - c. Other sub-specialty cases.
  - C. Teaching/Methodology.
    1. Lecture/Discussions.
    2. Practical session.
      - a. Color vision testing.
      - b. Visual field examination.
      - c. Ocular motility testing.
      - d. Use of contact lenses.
      - e. Use of computers.
      - f. Assisting in staining, scraping corneal ulcers.
      - g. Assisting in surgeries.
        - i. Cataract.
        - ii. Glaucoma.
        - iii. Other sub-specialty cases.

### VIII. Semester 3: Exit Competencies

1. Will be able to refract and prescribe.
2. Elicit patient information.
3. Assisting in cataract surgery.
4. Identify common diseases.
5. Identify and act on emergencies.
6. Organize and perform in an eye camp set up.

## Curriculum for Hospital-based Para-ophthalmic Personnel SEMESTER 4

### I. Seminars

Perform all skills independently with periodic supervision.

### II. Workshops

Perform all skills independently with periodic supervision.

### III. Semester 4: Exit Competencies

1. Will be able to refract and prescribe.
2. Elicit patient information.
3. Assist in cataract surgery.
4. Identify common diseases.
5. Identify and act on emergencies.
6. Organize and perform in an camp set up.

### Teaching Aids

- A. Model eye, specimens, posters.
- B. Printed materials, self-study materials.
- C. Slides.
- D. Videos/DVDs, CD-ROM, Internet.

### Evaluation of Trainees

- A. Mandatory Attendance: 80% attendance in Theory; 80% attendance in Practical.
- B. Maintenance of Logbook.
- C. Internal assessment (60%):
  - a. Continuous assessment (20%).
  - b. Periodic assessment (40%).
- D. Final Assessment (40%):
  - a. Theory and Practical/Clinical at end of two years.
- E. Assessment in local language.
- F. Minimum Pass Marks - 50% or higher on Theory and Practical/Clinical examinations.
- G. For candidates who fail, re-examination after six months.

### Time Allocation

- A. Semesters: 4.

- B. Lectures/Demonstrations: 100 hours/Semester.
- C. Seminars: Total 20 hours at 2 hours each over the entire course.
- D. Case Discussions: 20 over the entire course.

#### Theory Hours

- A. Basic Sciences: 20%.
- B. Eye Diseases: 20%.
- C. Operating Room: 15%.
- D. Refraction: 25%.
- E. Community Ophthalmology: 20%.

#### Practical Hours

- A. Outpatient Department and Refraction: 40%.
- B. Inpatient Department: 20%.
- C. Operating Room: 30%.
- D. Field Work: 10%.

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## V. Curriculum for Orthoptists

Orthoptics is a field of allied health in ophthalmology that specializes in the study, evaluation, and treatment of defects of binocular vision, strabismus, and amblyopia in children and adults. The number of orthoptists vary from country to country, and their specific job description depends on the needs of the individual country in which they work.

The training of orthoptists around the world also varies according to these needs. India, for example, has developed a six-month course that only accepts students with previous optometric or "refractionist" training. In India, students are available who are well trained in the basic anatomy and physiology of the eye and the visual system, and they don't require the basic training that is necessary for students without prior ophthalmology experience.

In North America, the American and Canadian Orthoptic Councils that oversee the training and certification of orthoptists, have a two-year curriculum for college graduates with no previous ophthalmology experience. There is the opportunity for advanced standing (usually one year) for students that hold advanced certification as allied health personnel in ophthalmology. The advanced certification by the Joint Commission on Allied Health Personnel in Ophthalmology (JCAHPO) is either as a Cer-

tified Ophthalmic Technician (COT) or as a Certified Ophthalmic Medical Technologist (COMT). These organizations provide certification to their target groups, but they do not provide an advanced degree in the fields of orthoptics or allied health in ophthalmology. Dalhousie University in Halifax, Nova Scotia, Canada has recently developed an advanced course in orthoptic training, lasting three years that leads to a Masters Degree in Visual Science.

Much of what is included in this curriculum is taken with permission directly from the curricula already established by the programs at Aravind Eye Hospital in Madurai, India, and from the American Orthoptic Syllabus, recently modified by the Education Committee of the American Association of Certified Orthoptists. Each of these programs has set their curricula to reflect the needs of their own environment. It is expected that any suggested curriculum developed here will be taken and modified for use by each local program. The essentials for orthoptic training are similar to all and will be listed first.

### Orthoptic Needs

Children are difficult to examine and an experienced examiner requires considerable time to perform almost any test. Whereas the visual acuity examination is an easy procedure in an adult and older child, it becomes difficult with a toddler and nearly impossible in an infant or neonate. This is an important concern when dealing with diseases where it is mandatory to monitor visual improvement or deterioration. Orthoptists are specifically trained to recognize, examine, and in some cases, treat the problems of amblyopia and strabismus in children and adults. They provide the "physician extender" role that allows the highest quality of care to these patients and allows the ophthalmologist to provide efficient and focused care.

### Curriculum Objectives

The specific needs of the individuals being trained will require the inclusion of basic science topics, including anatomy, physiology, general medicine, etc. These will be included in the appendices. The basic curriculum for orthoptic training must include gaining knowledge and expertise in the following areas:

1. Vision estimation in neonates, infants, toddlers, and young children.
2. Diagnosis of all forms of strabismus including abnormalities of binocular single vision.
3. Detection and management of amblyogenic factors and amblyopia in all age groups in the pediatric population. Familiarity with and ability to use the various instruments in the eye department which are used for the above purposes.
4. Good communication skills with the child and the parents.

### Secondary Curriculum Objectives

Based on the needs of the local community, secondary objectives may be included in the curriculum that are not necessarily thought of as being part of basic orthoptic training. These may include knowledge of and technical expertise in:

1. Refraction and common refractive errors in the pediatric population.
2. Visual field examination.
3. Tonometry.

### Eligibility Criteria

In general, a background in science, experience in medicine as an assistant or in specific aspects of ophthalmology such as oph-



thalmic nursing, ophthalmic assistant, optometry, “refractionist,” etc., are useful, but it is certainly possible to train interested, enthusiastic individuals from any background.

### Training Faculty

The Program Director should be a senior orthoptist with at least five years of experience in the field. The Medical Director should be a trained pediatric ophthalmologist or an ophthalmologist with experience in working with children.

### Training Facility

The training facility should be an ophthalmology department in a large, clinically busy, academic setting that provides the necessary space, access to patients with professional oversight, library facilities (see Appendix I), and freedom to study.

### Goals of Training

It is important to list the goals of training in any educational program. In the case of orthoptic training, the following is a good example of the goals to be achieved.

At the Conclusion of training, the student should be able to demonstrate understanding and have skills in all of the following: history taking, family history, past medical history, review of pertinent systems, presence of allergies to medications, and current medications; children’s distance and near visual acuity recording; cover tests (to include single cover test, cross cover, or alternate cover test); assessment of ductions and versions (ocular movement tests), Hirschberg method, Krimsky method, prism cover tests, including simultaneous prism and cover testing, with and without glasses, the Worth four-dot test, stereopsis testing; near point of convergence, convergence and divergence; amplitudes, both horizontal and vertical, near point of accommodation, grades of binocular vision; diplopia charting, (e.g., Hess charting); normal and abnormal retinal correspondence; angle of deviation in all cardinal positions of gaze; three-step test; and eccentric fixation detection.”

### Short Course Plan

The course plan will depend on the local needs and availability. The following description of a short course (six months) shows many of the characteristics of any program, regardless of length.

### Short Course

Based on the Orthoptic Training Course at Aravind Eye Hospital, Madurai, India, for students with some prior background in ophthalmology. Teaching modes include video on extraocular muscles, anatomy, and physiology; examination of a case of strabismus; and handouts on almost all the topics.

**Duration of the Course:** 24 Weeks (six months);  
Monday – Saturday

**Total Classes:** a. Theory: 36 classes, 1-hour each  
b. Discussion: as necessary, 1-hour each

**Hours of Work:** Monday – Saturday:  
7:30 a.m. – 6:00 p.m.

### Day Breakdown:

8:00 a.m. – 9:00 a.m.: Theory classes or Discussion  
9:00 a.m. – 1:00 p.m.: Pediatric Ophthalmology/Strabismus Department  
1:00 p.m. – 2:00 p.m.: Lunch

2:00 p.m. – 5:00 p.m.: Pediatric Ophthalmology/Strabismus Department

5:00 p.m. – 6:00 p.m.: Library

### Phase I: Basics Science

6 weeks

- Development of the eye and its functions.
- Anatomy of the extraocular muscles.
- Physiology of extraocular movements.
- Physiology of acuity of vision, color vision, field of vision, binocular single vision, convergence and accommodation.

### Phase II: Basics in Strabismus Management and Orthoptic Practice

8 weeks

- Various methods of vision estimation in children for all age groups including checking the fixation pattern, central, steady and maintained fixation preference (CSM); induced tropia with prism; Teller Acuity Cards, Cardiff Acuity Cards, Cambridge Crowding Cards, Allen cards, and other matching cards. Methods of recording results will be introduced.
- Measurement of convergence and accommodation, and detection of their anomalies.
- Examination of all types of strabismus, including concomitant and incomitant squint.
- Examination and diagnosis of special forms of strabismus including syndromes in strabismus and preoperative and postoperative diplopia.
- Diagnosis and management of various types of amblyopia.
- Non-surgical management of strabismus and amblyopia including optical correction, orthoptic exercises, prism therapy, orthoptic counseling, penalization, occlusion therapy.
- Knowledge of the surgical management of strabismus, including surgical procedures such as muscle resection and recession and postoperative orthoptic evaluation.
- Exposure to other common pediatric eye problems, including various amblyogenic factors.

### Phase III: Clinical Exposure in Orthoptic Evaluation

10 weeks

- Principle, construction, and use of orthoptic equipment.
  - Occluder and fixation targets.
  - Children’s vision acuity charts (e.g., LEA Symbols, HOTV, Allen cards).
  - Prism bar, loose prisms.
  - Fusion testing, e.g., the Worth four-dot test.
  - Stereopsis testing, e.g., TNO, Titmus, Lang, etc.
  - Bagolini lenses.
  - Double Maddox rod.
  - Maddox rod/Maddox wing.
  - Hess-Lees screen.
  - Synoptophore, if available.
  - Diploscope.
  - Various small devices for orthoptic exercises.

### Pediatric Refraction

When indicated, the program may require and provide training in: atropine refraction, cyclopentolate refraction, refraction during examination under anesthesia (EUA), retinoscopy in childhood aphakia and pseudophakia, glasses prescription, pediatric contact lenses, tonometry, and visual fields.



## Long Course

In North America, the training course for orthoptists is usually two years, after having earned a university degree. As noted above, this may be shortened for individuals with prior experience or those who have obtained advanced certification in allied health in ophthalmology by JCAHPO. These longer programs are also arranged so that Phase I, the didactic course in basic sciences, is usually presented during the first few months. More advanced didactic training, (see Phases 2 and 3 above) is usually done weekly during the entire course of study with the rest of the time spent in the clinic, observing and examining patients. A minimum number of complete patient exams is required by the American Orthoptic Council each year of the course. Throughout the course, students are tested to ensure that they are obtaining the necessary knowledge before progressing on to the next level. Each program develops their own lesson plans for their didactic teaching.

### Class Lesson Plans

Appendix II, lists the specific areas to be covered during the didactic portions of the course. It is taken from the recent AACO modification of the American Orthoptic Council's Orthoptic Syllabus and is the guide used for the two-year programs in the United States and Canada. It is very specific as to the topics to be covered, but it is to be used only as a guideline as to what material is expected to be taught. Appendix II is the basis for the material covered in the final written and oral examinations for certification by the American Orthoptic Council.

### Documentation

A logbook should be kept to document the number and types of patients the student has seen/personally examined.

### Assessment

At regular intervals, the student should be examined to determine adequate progress. Students should obtain passing marks in each phase assessment before beginning the next phase. A suggested plan would include:

1st Assessment:	End of the 1st Phase (6th week)
2nd Assessment:	End of the 2nd Phase (14th week)
3rd Assessment:	End of the 3rd Phase (24th week)

### Final Assessment

Written: 3 parts	Total Marks 3 x 100 = 300
Practical/Case/Viva Voce	= 100
TOTAL:	400

### Paper Distribution

A program may require written papers to be prepared by the student. A suggested list of papers and timing within the course is shown below:

#### 1. Part I

- Paper Heading:* Basic Sciences.
- Contents:* Anatomy of extraocular muscles, physiology of extraocular movements, physiology of binocular single vision, convergence and accommodation.

#### 2. Part II

- Paper Heading:* Basics in Strabismus Management and Orthoptic Practice.

- Contents:* Vision estimation in children, types of strabismus, amblyopia, non-surgical and surgical management of strabismus.

#### 3. Part III

- Paper Heading:* Clinical Exposure in Orthoptic Evaluation and Management.
- Contents:* Orthoptic instrumentation and usage, pediatric refraction (as needed).

## Appendix I



### Suggested Readings/Library Holdings

- Edelman PM, American Orthoptic Council. Syllabus Committee, American Academy of Ophthalmology. Allied Health Education Committee. Orthoptics: a syllabus of ocular motility. 2nd ed. San Francisco, Calif.: American Academy of Ophthalmology, 1992; xv: 107
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## Appendix II



Lesson plans for topics to be covered in didactic lectures. (From the AACO modification of the American Orthoptic Syllabus)

### Anatomy

#### I. Orbit

- Bones and their relationships.
- Openings.
- Contents.
- Function.
- Blood supply.
- Nerve supply.
- Common Disorders.
  - Trauma.
  - Inflammation.
  - Dystopia.
  - Tumor.
  - Orbital apex syndrome.

## II. Eyelids

- A. Structure.
  1. Five principle plains of tissue: skin, striated muscle, areolar tissue, fibrous tissue, mucous membrane.
  2. Lid margins: anterior to posterior, eyelashes, Zeis glands, Moll glands, posterior lid margin, lacrimal punctum.
  3. Palpebral fissure.
  4. Lid retractors: levator palpebrae superioris, Mueller's muscle, inferior rectus.
- B. Function.
- C. Blood supply.
- D. Nerve supply.
  1. Sensory fibers.
  2. Motor fibers.
- E. Common disorders: blepharoptosis, blepharochalasis, ectropion, entropion, chalazion, hordeolum, blepharitis, fissure slant, blepharophimosis, trichiasis, blepharospasm, myokymia, dehiscence, Marcus-Gunn jaw winking syndrome, telecanthus, lagophthalmos.

## III. Lacrimal Apparatus

- A. Structure.
  1. Components.  
Lacrimal gland, accessory glands in conjunctiva, pumping action of lids, puncta, canaliculi, lacrimal sac, nasolacrimal duct.
  2. Tear structure.
    - a. Oily layer, outer layer, secreted by meibomian glands, prevents rapid evaporation.
    - b. Aqueous layer: middle layer, secreted by lacrimal gland, composes majority of tear film.
    - c. Inner mucin (mucous) layer: inner layer, closest to cornea, secreted by goblet cells of conjunctiva, smoothes corneal epithelial surface.
- B. Function.
- C. Blood Supply.
- D. Nerve Supply: sensory fibers, motor fibers.
- E. Common disorders: epiphora, nasolacrimal duct obstruction, dacryoadenitis, dacryocystitis, congenital alacrima, keratoconjunctivitis sicca.

## IV. Conjunctiva

- A. Structure.
- B. Function.
- C. Blood supply.
- D. Nerve supply.
- E. Common Disorders: conjunctivitis, cysts, telangiectasias, Stevens Johnson syndrome, chemosis.

## V. Globe

- A. Cornea.
  1. Structure.
  2. Function.
  3. Blood supply.
  4. Nerve supply (sensory only).
  5. Common disorders: keratoconjunctivitis sicca, keratoconus, microcornea, corneal dystrophies, congenital corneal defects, buphthalmos, Haab's striae, corneal abrasion/scar, band keratopathy, neovascularization.
- B. Anterior Chamber and Angle.
  1. Structure.
  2. Function.
  3. Common disorders: glaucoma, ocular hypertension, hyphema, hypopyon, hypotony.

## C. Uveal Tract (middle vascular layer of the eye).

1. Iris.
  - a. Structure.
  - b. Function.
  - c. Blood supplied by major circle of iris.
  - d. Nerve supply.
  - e. Common disorders or anomalies: coloboma, nevus, corectopia, anisocoria iritis, Brushfield spots, Lisch nodules, aniridia, transillumination defects, synechiae.
2. Ciliary body.
  - a. Structure.
  - b. Function.
  - c. Blood supply.
  - d. Nerve supply.
  - e. Common disorders: iridocyclitis, abnormalities of aqueous outflow.
3. Choroid.
  - a. Structure.
  - b. Function.
  - c. Blood supply from long posterior ciliary arteries.
  - d. Sensory nerve supply by ciliary nerves.
  - e. Common Disorders: chorioretinitis choroidal detachment, choroidal folds, choroidal hemorrhage, nevus, tumors, choroideremia.

## D. Lens.

1. Structure.
2. Development and aging.
3. Function.
4. Common disorders: cataract, presbyopia/hypoaccommodation, ectopia lentis.

## E. Vitreous.

1. Structure.
2. Vitreous development.
3. Function.
4. Common disorders and anomalies: persistent hypoplastic primary vitreous (PHPV), Mittendorf's dot, Bergmeister's papilla, posterior vitreous detachment (PVD), floaters, vitreous hemorrhage, asteroid hyalosis.

## F. Retina.

1. Structure.
2. Function.
3. Blood supply.
4. Common disorders: retinopathy of prematurity, dyschromatopsia, tumor (retinoblastoma), retinitis pigmentosa, retinal detachment, tear or hole, toxoplasmosis or toxocara, age-related macular degeneration, coloboma, central retinal artery occlusion, central retinal vein occlusion, retinal dystrophy.

## G. Sclera

1. Structure.
2. Function, protection, and support.
3. Blood supply.
4. Common disorders: scleritis, episcleritis, nevus, dermoid.

## VI. Optic Nerve

- A. Nerve fibers.
  1. Composed of one million ganglion cell axons.
  2. Four segments:
    - a. Intraocular (optic disc).
    - b. Intracranial.

- c. Intraorbital.
  - d. Intracranial.
  - 3. Glial cells.
    - a. Astrocytes.
    - b. Oligodendrocytes.
  - B. Support Structures (Meninges).
    - 1. Pia mater.
    - 2. Arachnoid mater.
    - 3. Dura mater.
  - C. Blood Supply.
    - 1. Central retinal artery.
    - 2. Short posterior ciliary arteries.
    - 3. Ophthalmic artery.
  - D. Common disorders: apasia/dysplasia, hypoplasia and de-Morsiers syndrome, coloboma, optic atrophy, papilledema, pseudopapilledema, tilted disc, drusen, optic neuritis/papillitis, myelination of nerve fibers.
- VII. Extraocular Muscle**
- A. Characteristics of striated muscle.
  - B. Extraocular muscle differs from other striated skeletal muscle.
    - 1. Anatomic differences.
    - 2. Physiological differences.
  - C. Extraocular muscle types.
    - 1. Rectus muscle.
    - 2. Oblique muscle.
  - D. Fascia.
    - 1. Tenon's capsule.
    - 2. Ligaments.
    - 3. Intermuscular septum.

## Neuroanatomy

- I. Brain**
  - A. Cerebrum.
  - B. Vascular system.
  - C. Ventricles.
  - D. Meninges.
  - E. Cerebellum.
  - F. Brain stem.
  - G. Medial longitudinal fasciculus (MLF).
- II. Spinal Cord**
  - A. Located in the vertebral canal of the spinal column.
  - B. Functions.
- III. Pathway of the Cranial Nerves**

Optic nerve, oculomotor nerve, trochlear nerve, abducens nerve, trigeminal nerve, facial nerve, acoustic nerve.
- IV. Visual Pathway**
- V. Autonomic Nervous System**
  - A. Sympathetic.
  - B. Parasympathetic.
  - C. Path of light reflex.
  - D. Dilator pathway.
  - E. Path of the accommodation reflex.
  - F. Clinical conditions: Argyll-Robertson pupils, Marcus-Gunn pupil, Horner's syndrome, Adie's pupil, aberrant regeneration of III cranial nerve, complete III cranial nerve palsy, internal ophthalmoplegia.

## Sensory Physiology and Pathology

- I. Physiology of Normal Binocular Vision**
  - A. Objective and subjective visual space.
  - B. Lines of direction and visual directions.
    - 1. Visual direction.
    - 2. Principle visual direction.
    - 3. Secondary visual direction.
  - C. Corresponding retinal points.
  - D. Horopter.
  - E. Panum's fusion area.
  - F. Fusion.
    - 1. Sensory fusion.
    - 2. Motor fusion.
  - G. Depth perception.
  - H. Retinal rivalry.
- II. Abnormalities of Binocular Vision**
  - A. Diplopia.
  - B. Confusion.
  - C. Suppression.
  - D. Amblyopia.
  - E. Anomalous retinal correspondence.

## Motor Physiology

- I. Basic Principles**
  - A. Functional geometry and geometric optics of the eye.
    - 1. Major axes and angles.
    - 2. Nodal points of the eye.
    - 3. Radius of curvature.
    - 4. Midsagittal plane.
  - B. Kinematics of Ocular Rotations.
    - 1. Types of movements.
    - 2. Center of rotation of the globe.
    - 3. Fick's axes.
    - 4. Degrees of freedom of motion of the globe.
  - C. Physiology of muscle contraction.
    - 1. Fibers.
      - a. Number of fibers/muscle.
      - b. Fiber size.
      - c. Fiber types.
      - d. Histochemistry.
      - e. Location of fibers.
    - 2. Innervation types.
    - 3. Muscle force.
  - D. Extraocular muscle action.
- II. Eye Movements**
  - A. Simple Eye Movements.
    - 1. Monocular (ductions).
    - 2. Sherrington's Law.
    - 3. Terminology.
      - a. Agonist.
      - b. Antagonist.
      - c. Synergist.
  - B. Complex Eye Movements.
    - 1. Binocular (versions).
    - 2. Hering's law.
    - 3. Terminology.
    - 4. Purpose of complex eye movements.
    - 5. Types.
      - a. Movements that stabilize gaze: vestibular, optokinetic, fixation maintenance.
      - b. Movements that shift gaze to put an image onto the fovea: saccades, pursuit, vergence.

### Functional Classification of Eye Movements

Movement	Main Function
Visual Fixation	Holds the image of a stationary object on the fovea when the head is stationary
Vestibular	Holds images steady on the retina during brief head rotations
Optokinetic	Holds images steady on the retina during sustained head rotation
Smooth Pursuit	Holds image of the moving target on the fovea
Saccades	Brings images of objects of interest onto the fovea
Vergence	Moves eyes in opposite directions so that images are placed simultaneously on both foveas

### III. Supranuclear Control Systems for Eye Movements

- The vestibular and optokinetic systems (non-optic eye movements).
- Smooth pursuit.
- Saccadic eye movements.
- Vergence eye movements.
- Fixation maintenance.

### IV. Principles of Clinical Examination of Eye Movements

- Basic features of all eye movements: latency, velocity, accuracy.
- Measurement and recording techniques.
  - Measure position and velocity (in order of accuracy).
  - Measuring neural sign.
- Clinical examination of VOR-OKN function.
- Clinical examination of pursuit: technique, initiation (latency), gain (accuracy), symmetry.
- Clinical examination of saccades: velocity, latency, accuracy, localization of defect.
- Clinical examination of vergence.
  - Tools: prism bar, rotary prism, loose prisms, amblyoscope.
  - Blur, break, and recovery point.
  - Absolute vs. relative vergence.
- Clinical examination of fixation.

## Pharmacology

### I. Pharmacologic Nomenclature

#### II. Terminology

- Functional terms.
- Pharmacologic characteristics.
  - Tonicity.
  - Buffers.
  - pH.
  - Stability shelf life.
  - Solution, suspension, or ointment.

#### III. History Taking

#### IV. Routes of Administration

- Topical.
- Systemic administration.

#### V. Autonomic Nervous System

- Pathways and ocular innervation.
  - Parasympathetic.
  - Sympathetic.
- Neurotransmitters.
  - Acetylcholine.
  - Norepinephrine.

### VI. Important Pharmacologic Agents and their Characteristics

- Parasympathetic agonists.
  - Direct-acting.
  - Indirect-acting.
- Parasympathetic antagonists (parasympatholytics).
- Sympathetic agonists.
- Sympathetic antagonists (beta-blockers).
- Carbonic anhydrase inhibitors.
- Prostaglandin analogs.
- Osmotics.
- Corticosteroids.
- Anesthetics.
- Biological dyes: fluorescein, rose bengal.

### VII. Pharmacologic Tests for Pupillary Syndromes: Adie's syndrome, Horner's syndrome

### VIII. Use of Pharmacologic Agents in the Treatment and Diagnosis of Strabismus

Cholinesterase inhibitors, botulinum toxin, Tensilon, neostigmine, Mestinon.

### IX. Pharmacology Supplement

- Anti-metabolites used in glaucoma filtering procedures: 5-fluorouracil, mitomycin-C.
- Pharmacologic adjuncts to retinal surgery: intravitreal gasses, C3F8 & SF6, silicone oil.
- Perfluorocarbon heavy liquid.
- Pharmacologic treatment of ocular allergies: NSAIDs, decongestants, antihistamines, mast cell stabilizers.
- Treatment of ocular manifestations of AIDS.
- Treatment for CMV retinitis: Foscarnet, Gancyclovir, antibiotics, antifungals, antivirals.

## Ophthalmic Optics

### I. Physical Optics

- Light.
- Electromagnetic spectrum.

### II. Reflection

### III. Absorption vs. Transmission

### IV. Refraction of Light Rays

### V. Lenses: Calculations

### VI. Mirrors

### VII. Telescopes

### VIII. Vertex Distance

### IX. Determination of Ophthalmic Lens Power

### X. The Eye as an Optical System

- Refractive components of the eye.
- Axial length.
- Nodal point of the eye.
- Refractive states.

### XI. Accommodation

- Mechanism.
- Range and amplitude.
- Presbyopia.

### XII. Contact Lenses

- Relevant corneal anatomy and physiology.
- Instruments used in contact lens evaluation and fitting.
- Lens characteristics.
  - Rigid lenses.
  - Soft lenses.
  - Contact lens parameters.

## Vision Testing

### I. Terminology and Principles of Subjective Tests

- A. Minimum separable.
- B. Minimum resolvable.
- C. Minimum visible.
- D. Numerator and denominator for visual acuity.
- E. Crowding phenomenon.
- F. Type of occlusion.
- G. Pinhole effect.
- H. Presentation of chart.
- I. Principles of neutral density filter.
- J. Tests in the presence of nystagmus.

### II. Objective Tests

- A. Importance of history.
  1. Observation.
  2. Fixation tests.
  3. Cross fixation.
  4. Fixation switch at midline.
- B. Light reaction.
- C. Vision function testing.
  1. Handling beads.
  2. Forced choice preferential looking (FPL).
  3. Optokinetic nystagmus.
  4. Visually evoked potential/response (VEP/ER).
  5. Electroretinogram.

### III. Tests of Malingering

- A. Optical (lens tricks).
- B. Vectograph.
- C. Synoptophore.
  - D. Duochrome.
  - E. Stereoacuity.
  - F. Optokinetic devices.
  - G. Teller cards.

### IV. Vision Screening

- Part 1: Screening Fundamentals.  
 Part 2: Designing and Implementing a Screening Program.
- A. Identify a target group of patients.
  - B. Describe benefits and drawbacks of program targeted to:
    1. School-age population.
    2. 4–5 year old Well-Child Program.
    3. 2–4 year old Well-Child Program.
    4. Infant program.
  - A. Identify facility for screening to take place.
  - B. Develop forms.
    1. Screening forms.
    2. Referral forms.
    3. Follow up forms for parents/guardians.
  - A. Educate screeners.
    1. Pediatricians.
    2. Family practitioners.
    3. Nurses.
    4. School districts.
    5. Service groups.
  - B. Establish screening technique for visual acuity testing.
    1. Select appropriate screening method per age group.
  - C. Establish screening technique for ocular alignment testing.
    1. Select appropriate screening method for age group.
      - a. Sensory.
      - b. Motor.

- D. Set referral criteria for target group.
  1. Vision.
  2. Alignment.

- E. Identify other causes for referral.
  1. Red, watery eyes.
  2. Ptosis.
  3. Leukocoria.
  4. Nystagmus.
  5. Compensatory head posture.

## Sensory and Motor Testing

### I. Sensory Testing

- A. Vision testing.
- B. Visual field testing.
- C. Assessment of fusion.

### II. Motor Testing

- A. Identify and define.
  1. Orthophoria.
  2. Heterophoria.
- B. Basic deviation.
- C. Explain and demonstrate:
  1. Cover tests with and without prism.
  2. Corneal light reflex tests.
  3. Dissimilar (one target) tests.
  4. Dissimilar (two target) tests.
- D. Identify pseudostrabismus.
- E. Identify and measure angle kappa (positive and negative).
- F. Evaluation of ocular motility including:
  1. Positions of gaze.
  2. Measurement of deviation in all positions of gaze.
  3. A and V patterns.
  4. Near vs. distance deviation.
    - a. Classification.
    - b. Calculation of AC/A ratio.
  5. Near point of convergence.
  6. Three-step test.
  7. Evaluation of ocular excursions.
  8. Clinical evaluation of eye movement systems: saccades, pursuit, vergence, optokinetic nystagmus (OKN), vestibulo-ocular reflex (VOR).
- G. Describe ancillary tests:
  1. Forced duction testing.
  2. Active forced generation testing.
  3. Saccadic velocity testing.
  4. Electromyography.
  5. Tensilon/prostigmin testing.
  6. Differential intraocular pressure.

## Eso deviations

### I. Congenital (Infantile, Essential)

- A. Classic type.
- B. Early onset with accommodative component.
- C. Nystagmus blockage syndrome (or nystagmus compensation syndrome).
- D. Ciancia syndrome.
- E. Duane's syndrome.
- F. Abducens palsy.
- G. Möbius syndrome.

### II. Acquired Eso deviations

- A. Accommodative esotropia.  
Types:

- a. Refractive (aka: refractive accommodative or fully accommodative).
  - b. High AC/A ET (aka: nonrefractive accommodative).
  - c. Mixed mechanism ET (aka: partially accommodative).
- B. Non-accommodative esotropia.
- 1. Basic esotropia.
  - 2. Non-accommodative convergence exeso.
  - 3. Acute comitant esotropia.
  - 4. Cyclic esotropia.
  - 5. Idiopathic.
  - 6. Decompensated accommodative esotropia.
- C. Sensory esotropia.
- D. Divergence insufficiency.
- E. Divergence paralysis.
- F. Spasm of the near reflex.
- G. Medial rectus restriction.
- H. Lateral rectus weakness.
- I. Surgical esodeviation (consecutive).

### III. Pseudo-esotropia

### IV. Monofixation Syndrome

### V. Microtropia

## Exodeviations

### I. Etiology

- A. Unknown.
- B. Innervational abnormalities.
- C. Hereditary.
- D. Monocular vision loss.

### II. Classification

- A. By distance-near relationship.
  - 1. Basic exodeviation.
  - 2. Divergence excess.
  - 3. Convergence insufficiency.
- B. By fusional status.
  - 1. Phoria.
  - 2. Intermittent tropia.
  - 3. Tropia.
- C. By age of onset.
  - 1. Congenital (infantile).
  - 2. Acquired.

### III. Clinical Types

- A. Pseudoexotropia.
- B. Exophoria.
- C. Intermittent exotropia.
- D. Exotropia.
- E. Congenital exotropia.
- F. Sensory exotropia.
- G. Consecutive exotropia (aka: secondary exotropia).
- H. Supranuclear exotropia.
- I. Convergence insufficiency syndrome.
- J. Third nerve palsy.
- K. Duane's syndrome Type II.

## Vertically Incomitant Horizontal Strabismus

### I. Definition

- A. A-pattern.
- B. V-pattern.
- C. Others:
  - 1.  $\lambda$  (lambda).
  - 2.  $\diamond$  (diamond).
  - 3. X pattern.

- 4. Y pattern.
- 5.  $\uparrow$  pattern.

### II. Prevalence

~ 25% of total horizontal strabismus, V-ET is most common, A-XT is least common.

### III. Examination

- A. Measure at distance. If must be done at near, control accommodation to avoid misdiagnosing V-pattern.
- B. Chin down ~ 25° for up-gaze, and chin up ~ 25° for down-gaze.
- C. Note presence of compensatory head posture.

### IV. Etiology

- A. Horizontal rectus school of thought:
  - 1. Medial rectus is believed to cause increased convergence in down-gaze.
  - 2. Lateral rectus is believed to cause increased divergence in up-gaze.
- B. Oblique dysfunction: Tertiary action of the obliques is abduction.
- C. Vertical rectus: The tertiary function of the vertical recti is adduction.
- D. Sensory torsion: Poor fusion causes globe to move to a position of rest over time.
- E. Structural causes (craniofacial anomalies).

## Vertical Deviations

### I. Superior Oblique Palsy

- A. Characteristics:
  - 1. Hypertropia of affected eye.
  - 2. Abnormal head posture is common.
  - 3. Excyclotropia.
  - 4. May be bilateral.
  - 5. Positive Bielschowsky head tilt test.
  - 6. V-pattern in bilateral cases.
  - 7. Diplopia when acquired.

### II. Inferior Oblique Palsy

- A. Characteristics:
  - 1. Onset may not be well documented.
  - 2. A-pattern.
  - 3. Ipsilateral superior oblique overaction.
  - 4. Negative forced ductions.
  - 5. May have compensatory head posture.
  - 6. May have incyclotropia.

### III. Inferior Rectus Paresis

- A. Etiology:
  - 1. Trauma to the III nerve of inferior rectus muscle.
  - 2. Myasthenia gravis may mimic.
- B. Characteristics:
  - 1. Hypertropia of involved eye in primary position (unless associated with trauma and entrapment).
  - 2. Deviation increases with involved eye in abduction.

### IV. Inferior Oblique Overaction

- A. Characteristics:
  - 1. Elevation of the eye in adduction.
  - 2. V-pattern may be present.
  - 3. May be bilateral, symmetric, or asymmetric.
  - 4. May be primary, or secondary to superior oblique (SO) palsy.
  - 5. Common finding associated with childhood-onset horizontal strabismus.



**V. Superior Oblique Overaction****B. Characteristics:**

1. Hypotropia of the involved eye, worse in adduction.
2. A-pattern may be present.
3. May be primary or secondary to inferior oblique (IO) palsy.
4. Relatively common finding in childhood-onset horizontal strabismus.
5. May be associated with skew deviation.
6. May be associated with neurological deficits in young children.

**VI. Brown Syndrome****A. Limitation of elevation.****B. Characteristics:**

1. Grossly symmetrical limitation of elevation across superior fields.
2. May be associated with chin-up posture.
3. Ptosis or pseudo-ptosis may be present.

**C. Types:**

1. Restriction of the IR.
2. Monocular elevation deficiency (aka: double elevator palsy).

**VIII. Orbital Floor Fracture****IX. Thyroid Ophthalmopathy****X. Dissociated Vertical Deviation****A. Characteristics:**

1. Updrift of eye under cover, or spontaneously during periods of visual inattentiveness.
2. Dissociated eye may also extort and abduct.
3. May be latent, intermittent, or manifest.
4. No associated hypotropia of the fellow eye.
5. Associated with latent nystagmus.
6. Associated with horizontal infantile strabismus.
7. Usually bilateral, but may be monocular or asymmetric.
8. May be superimposed on a true vertical deviation.
9. May mimic IO overaction.
10. Diplopia very rare.
11. Associated with poor binocular vision.

**XI. Vertical Skew Deviation****Paretic Strabismus****I. Supranuclear Disorders****A. Gaze palsy.**

1. Cerebrovascular accidents result in contralateral gaze palsy.
2. Roth-Bielschowsky syndrome.
3. Unilateral midbrain.
  - a. Loss of saccades and pursuit in opposite direction.
  - b. Contralateral gaze palsy.
  - c. Ipsilateral internuclear ophthalmoplegia and/or III nerve palsy.
  - d. Skew deviation.
4. Progressive supranuclear palsy.
5. Parkinson's disease.

**B. Ocular motor apraxia.**

1. Congenital.
  - a. Absence of saccadic refixations and smooth pursuit.
  - b. Preservation of vertical eye movements.
  - c. Absence of fast phase during OKN or caloric stimulation.
  - d. Head thrusts to accomplish refixations.

**2. Acquired.**

- a. Paralysis of volitional saccades and pursuit in all directions.
- b. OKN is absent.
- c. Vestibular nystagmus is normal.
- d. Normal random and visually evoked saccades but inability to move eyes on command.

**C. Cerebellar disorders.**

1. Cogwheel (saccadic) pursuit.
2. Hypometric saccades with reduced velocity.
3. Gaze palsy with eyes tonically deviated in the direction opposite to the lesion.
4. Skew deviation.
5. Inability to maintain upward gaze.

**D. Vertical gaze disorders.**

1. Dorsal midbrain syndrome.
  - a. aka: Parinaud's syndrome or Sylvian aqueduct syndrome.
  - b. Pupils show light-near dissociation.
  - c. Collier's sign (lid retraction).
  - d. Lid lag.
  - e. Paralysis of vertical gaze.
  - f. Bell's phenomenon and vestibulo-ocular responses may become paralyzed.
  - g. Attempts at upward saccades evoke convergence-retraction nystagmus.
  - h. Pinealomas and midbrain infarction are most common etiologies.
2. Down-gaze palsy.
  - a. Rare.
  - b. Lesion dorsal and medial to the red nuclei.
  - c. Associated with progressive supranuclear palsy.
3. Pontine lesions.
  - a. Up-gaze palsy.
  - b. Persistence of gaze-evoked nystagmus.

**E. Vergence disorders.**

1. Spasm of the near reflex.
  - a. Usually encountered in conversion hysteria patients.
  - b. Apparent unilateral or bilateral VI nerve paresis.
  - c. Pupillary miosis.
  - d. May be associated with generalized seizures.
  - e. May result from head injury.
  - f. Associated with Arnold-Chiari malformations.
2. Convergence paralysis.
  - a. Exotropia at near.
  - b. Diplopia.
  - c. May be organic or functional.
3. Divergence paralysis.

**II. Internuclear Disorders****A. Lesions of the paramedian pontine reticular formation.**

1. Ipsilateral gaze palsy.
  - a. If defect is located in upper pons, then vestibulo-ocular movements are intact.
  - b. If defect is at the level of the abducens nuclei, then vestibulo-ocular movements are abnormal.

**B. Lesions of the medial longitudinal fasciculus.**

1. Results in internuclear ophthalmoplegia (INO).
  - a. Lesion is found between the III and VI nerve nuclei.
  - b. Absent adduction on ipsilateral side.
  - c. Nystagmus, with fast phase directed into abduction on attempted abduction of the contralateral eye.

- d. Convergence may be absent if lesion is close to III nerve.
  - e. Subtle INO may be revealed with OKN testing, saccadic velocity testing, or ocular dysmetria.
  - 2. Etiology.
    - a. If unilateral, may be vascular.
    - b. If bilateral, may be multiple sclerosis.
  - C. Combination parapontine reticular formation with medial longitudinal fasciculus lesions.
    - 1. One-and-a-half syndrome (Fisher's syndrome).
      - a. Brain stem vascular disease.
      - b. Produces contralateral INO and ipsilateral horizontal gaze palsy.
- III. Intranuclear Disorders**
- A. Abducens (VI nerve) palsy.
    - 1. Etiology.
      - a. Increased intracranial pressure.
      - b. Head trauma.
      - c. Vascular hypertension.
      - d. Diabetes.
      - e. Post infection.
      - f. Pontine syndromes (infarction, demyelinating disease, tumor).
      - g. Cerebellopontine angle lesions (acoustic neuroma), clivus lesions. (nasopharyngeal carcinoma, clivus chordoma).
      - h. Middle fossa disorders (tumor, inflammation).
      - i. Cavernous sinus or superior orbital fissure disorders (tumor, aneurysm, inflammation).
      - j. Carotid-cavernous or dural arteriovenous fistula.
      - k. Lumbar puncture or spinal anesthesia.
      - l. Syphilis.
  - B. Trochlear (IV nerve) palsy.
    - 1. Etiology.
      - a. Traumatic.
      - b. Vascular.
      - c. Diabetes.
      - d. Posterior fossa tumor.
      - e. Cavernous sinus or superior orbital fissure syndromes.
      - f. Neurosurgical procedure.
      - g. Herpes zoster.
      - h. Idiopathic/congenital.
    - 2. Characteristics.
      - a. Hypertropia of involved eye.
      - b. Excyclotropia of involved eye.
      - c. V-pattern.
      - d. Positive Bielschowsky head tilt test.
      - e. Compensatory head posture.
      - f. Knapp's classification.
      - g. Assume bilateral until proven otherwise.
    - 3. Diagnostic Testing.
      - a. Versions.
      - b. Three-step test.
      - c. Double Maddox rod test.
      - d. Diplopia fields.
      - e. Objective (fundus) torsion.
  - C. Oculomotor (III nerve) palsy.
    - 1. Etiology.
      - a. Nuclear lesions.
      - b. Infarctions.
      - c. Demyelination.

- d. Metastatic tumor.
- e. Fascicular lesions.
- f. Benedikt's syndrome.
- g. Weber's syndrome.
- h. Interpeduncular lesions.
- i. Aneurysm.
- j. Trauma.
- k. Meningitis.
- l. Cavernous sinus lesions.
- m. Orbital lesions.
- n. Diabetic ophthalmoplegia.
- o. Guillain-Barré/Fisher syndrome.
- p. Ophthalmoplegic migraine.
- q. Cyclic III nerve palsy/spasm.
- r. Aberrant oculomotor regeneration.
- 2. Characteristics.
  - a. Ptosis.
  - b. Dilation of pupil.
  - c. Limitation of adduction, elevation, and depression.
  - d. Exotropia and hypotropia in primary position.
  - e. Accommodation weakness.
- D. Myasthenia Gravis.
- E. Dysthyroid myopathy.
- F. Myotonic dystrophy.

### Special Forms of Strabismus

#### I. Brown Syndrome

- A. Etiology.
  - 1. Congenital.
  - 2. Traumatic.
  - 3. Inflammatory.
  - 4. Iatrogenic.
- B. Characteristics.
  - 1. Limitation of elevation in adduction.
  - 2. Limitation does not improve on ductions.
  - 3. Forced ductions are positive.
  - 4. Normal or near normal elevation in abduction.
  - 5. Often Y-pattern XT.
  - 6. Often no strabismus in primary position.
  - 7. No superior oblique overaction.
  - 8. May have widening of lid fissure on adduction.
  - 9. May have head posture.
- C. Differential diagnosis.
  - 1. Orbital floor fracture.
  - 2. Endocrine myopathy.
  - 3. Double elevator palsy.
  - 4. IO paresis.
  - 5. III nerve paresis with aberrant regeneration.

#### II. Duane Syndrome

- A. Etiology.
  - 1. Congenital.
  - 2. Miswiring of lateral rectus muscle with branches from the medial rectus subnucleus.
  - 3. Autopsy cases confirmed absence of VI nerve nucleus.
- B. Classification.
  - 1. Type I.
  - 2. Type II.
  - 3. Type III.

#### III. Vertical Retraction Syndrome

- A. Characteristics.
  - 1. Limitation of depression and/or elevation.
  - 2. Globe retraction on vertical movement.

3. May be bilateral.
4. May be ET, XT, or orthotropic.
5. A and V patterns are common.

#### IV. Möbius Syndrome

- A. Characteristics.
1. VI, VII, and IX nerve pareses with sparing of the lower facial muscles.
  2. May also involve XII nerve.
  3. Aplasia of the involved brain stem nuclei.
  4. Absence of horizontal gaze.
  5. Associated congenital malformations.
  6. Difficulty with speech and facial expression; history of sucking difficulty at birth.
  7. Atrophy of terminal third of tongue.
  8. Often orthotropic in primary gaze.

#### V. Congenital Fibrosis

- A. Characteristics.
1. Usually familial (autosomal dominant).
  2. May affect only one muscle, or several, with severe limitation of ductions.
  3. Globes are often fixed into down-gaze.
  4. Marked ptosis OU.
  5. Chin elevation.
  6. Exotropia common.
  7. Anomalous convergence movements on attempted up-gaze or lateral-gaze.
  8. Amblyopia common.

#### VI. Strabismus Fixus

- A. Characteristics.
1. One or both eyes anchored in extreme adduction or abduction.
  2. Positive forced ductions.
  3. Usually caused by fibrosis of the muscles.

#### VII. Orbital Floor Fracture

- A. Etiology.
1. Blunt force trauma to the orbit.
- B. Characteristics.
1. Enophthalmos (occasionally proptosis).
  2. Chemosis.
  3. Periorbital hematoma.
  4. Persistent hypesthesia of the infraorbital area.
  5. Entrapment of the IR muscle, the IO muscle, and/or orbital contents.
  6. Hypotropia in primary position, increasing in up-gaze.
  7. May have IR damage and secondary IR paresis.
  8. Medial wall fracture may result in entrapment of medial rectus.

#### VIII. Myasthenia Gravis

#### Systemic Disease with Ocular Motor Involvement

##### I. Endocrine Ophthalmopathy

- A. Types
1. Thyrotoxic disease (aka: Graves' disease).
  2. Thyrotropic disease = (ocular signs).

##### II. Myasthenia Gravis

##### III. Multiple Sclerosis

##### IV. Chronic Progressive External Ophthalmoplegia (CPEO)

##### V. Diabetes

##### VI. Sylvian-Aqueduct Syndrome (aka: Parinaud's syndrome)

##### VII. Ischemia

#### VIII. Congenital Defects and Disorders

- A. Craniofacial dystosies.
1. Apert's syndrome.
  2. Crouzon syndrome.
- B. Craniosynostoses (premature closure of the bony sutures of the skull).
1. Plagiocephaly (uni-coronal synostosis).
  2. Trigenocephaly.
- C. Fetal alcohol syndrome.

#### Nystagmus

##### I. Terminology

- A. Definition: rhythmic, involuntary oscillation of the eyes.
- B. Alexander's Law: jerk nystagmus is accentuated in amplitude on gaze toward the direction of the fast phase.
- C. Wave form.
1. Jerk: anomalous slow phase away from fixation followed by fast, refixation saccades.
  2. Pendular: sinusoidal oscillations with no fast phase.
  3. Amplitude: magnitude of slow phase drift.
  4. Frequency: number of oscillations per unit measure of time.
  5. Intensity: amplitude x frequency.
    - a. Course: larger amplitude, low or moderate frequency.
    - b. Fine: small amplitude, high frequency.
  6. Foveation: time spent with the target on the fovea.
    - a. Foveation saccades: fast eye movements intended to break the oscillation cycle and increase foveation time.
- D. Null zone: gaze where the nystagmus intensity is minimal.
- E. Symptoms.
1. Oscillopsia: illusory movement of the environment.
  2. Vertigo: dizziness.

##### II. Nystagmus in Infancy and Childhood

- A. Congenital nystagmus.
- B. Latent (LN)/manifest latent nystagmus (MLN).
- C. Nystagmus blockage syndrome.
- D. Acquired nystagmus (in children).
1. Sensory nystagmus.
  2. Spasmus nutans.

##### III. Pendular

- A. Acquired pendular (aka: ocular myoclonus).
- B. Miner's nystagmus.
- C. Convergence-evoked nystagmus.
- D. See-saw nystagmus.
- E. Dissociated pendular.

##### IV. Jerk

- A. Vestibular.
- B. Gaze-evoked.
1. Physiologic (end point).
  2. Gaze paretic.
  3. Muscle paretic.
  4. Internuclear ophthalmoplegia.
  5. Rebound.
- C. Physiologic.
1. Optokinetic.
  2. Caloric.
- D. Toxic.

- E. Pathologic primary position nystagmus:
  1. Down-beat.
  2. Up-beat.
  3. Periodic alternating nystagmus (PAN).

#### V. Nystagmus Masquerades

(Non-nystagmoid oscillations and saccadic intrusions that may reflect cerebellar disease)

- A. Bobbing.
- B. Convergence-retraction.
- C. Dysmetria.
- D. Flutter.
- E. Myoclonus.
- F. Opsoclonus.
- G. Superior oblique myokymia.
- H. Square wave jerks.

#### VI. Examination

- A. Visual acuity.
- B. Ocular alignment.
- C. Anterior segment.
- D. Pupils.
- E. Fundus.
- F. Refraction.
- G. Electrophysiology.

#### VII. Treatment

- A. Neurologic work-up, if appropriate.
- B. Correction of significant refractive error.
- C. Amblyopia.
- D. Head posture.
- E. Low vision aids.
- F. Surgery.

### Non-Surgical Treatment

#### I. Antisuppression

- A. Diplopia awareness.
- B. Antisuppression.
  1. Patching.
  2. Amblyoscope (no longer used for this purpose).
  3. Binocular trainer.
  4. Cheiroscope.
  5. Physiologic diplopia exercises.
    - a. Two-pencil test.
    - b. Framing.
    - c. Diploscope.
    - d. Bar reading v. stereograms.

#### II. Stabilization of Fusion

- A. Near point of convergence.
- B. Convergence amplitudes.
- C. Divergence amplitudes.

#### III. Prism therapy

- A. Prism adaptation.
- B. Treatment with prisms.

### Principles of Strabismus Surgery

#### I. Indications

- A. Misalignment of the visual axes.
- B. Diplopia.
- C. Disfiguring head posture due to incomitance.
- D. Poor cosmetic appearance.
- E. Limitation of the binocular peripheral visual field.
- F. Discomfort on ocular rotations (due to contracture or adhesions).

#### II. Goals

- A. Alignment within 8° of orthotropia in primary position.
- B. Wide field of single binocular vision, including primary position and down-gaze.
- C. Full range of ocular rotations.
- D. Comitant deviation.

#### III. Techniques

- A. Weakening procedures.
  1. Recession.
  2. Tenotomy/myotomy.
  3. Tenectomy/myectomy.
  4. Muscle disinsertion.
  5. Z tenotomy.
  6. Posterior fixation suture.
  7. Botulinum toxin injection.
  8. Silicone expander.
  9. Denervation/extirpation.
- B. Strengthening procedures.
  1. Resection.
  2. Advancement.
  3. Tuck.
  4. Foster suture.
- C. Transposition procedures.
  1. Jensen procedure.
  2. Hummelsheim procedure.
  3. Knapp procedure.
  4. Harada-Ito procedure.
  5. Vertical displacement of the horizontal recti for pattern strabismus.
  6. Inferior Oblique anteriorization.
- D. Adjustable sutures.
- E. Recession of conjunctiva or Tenon's capsule.
- F. Traction sutures.

#### IV. Complications

- A. Intraoperative.
  1. Hemorrhage.
  2. Lost muscle.
  3. Scleral perforation.
  4. Pulled In Two Syndrome (PITS).
- B. Postoperative.
  1. Infection.
  2. Suture reaction.
  3. Granuloma
  4. Conjunctival cyst.
  5. Corneal dellen.
  6. Anterior segment ischemia.
  7. Muscle slippage.
  8. Restriction secondary to scarring.
  9. Adhesion syndrome.
  10. Over-or-under correction.

#### References

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2. Edelman PM, American Orthoptic Council. Syllabus Committee., American Academy of Ophthalmology. Allied Health Education Committee. Orthoptics: a syllabus of ocular motility. 2nd ed. San Francisco, Calif.: American Academy of Ophthalmology; 1992:xv, 107

## VI. Curriculum for Ophthalmic Technicians

Ophthalmic Medical Personnel (OMP) play an important role in the professional ophthalmology eye care team. Ophthalmic medical personnel possess knowledge and skills attained by didactic and clinical ophthalmic educational training. Formal training institutional programs are available in colleges, universities, and special educational institutions in many parts of the world. In addition, training can be an informal, on-the-job experience, with the support of the ophthalmologist employer of the OMP and the completion of an approved independent study course. In North America, training programs for Ophthalmic Medical Technicians (OMT) usually last two years. However, countries that choose to use the modules presented here are at liberty to adjust the period of training to suit their local needs. A well-trained OMT can be a tremendous help to any ophthalmologist and many of the tasks that ophthalmologists do in their busy practice can be delegated to the OMT.

The curriculum for training ophthalmic technicians presented here is adapted from the course content and outcome guide of the Portland Community College in Portland, Oregon, USA. It is copyrighted by the college, and is supplied courtesy of Joanne M. Harris, COT, Program Director, Ophthalmic Medical Technology, Portland Community College.

The following is an overview of the 24 course modules that comprise the curriculum of the Ophthalmic Medical Technicians program at Portland Community College. The synopsis of the courses offered in the program list the course title, credit hours, hours per week of lecture, and/or laboratory and course duration. A brief course description and course content, competencies, and skills are outlined for each course.

### Module I: Pharmacology/Eye Disease I Credit Hours: 2

#### I. Course Description

Designed to teach students the commonly administered ophthalmic drugs, appropriate uses, effects, dangers, and precautions as well as routes of administration and the legal records and ethical standards necessary for the physician. This is a study of major diseases of the eye and related structures integrated with symptomatology and treatment.

#### II. Course Content, Competencies and Skills

Eye Disease.

1. Describe four common refractive errors.
2. Define infection and inflammation.
3. List two classifications of inflammation and the ocular manifestation.
4. List possible causes of a red eye.
5. List different types of conjunctivitis.
6. Describe the two common forms of uveitis.
7. Discuss the signs and symptoms of Graves' disease.
8. Define thrombus, embolus, clot, aneurysm, ischemia, infarct, arteriosclerosis, myocardial infarct, cerebrovascular accident, and neovascularization.
9. List four ocular disorders caused by diabetes.
10. List common disorders of the cornea.
11. Discuss the causes, prognosis, and treatment of corneal abrasions.
12. Define cataract and list the various types and causes.
13. Describe the difference between primary open angle glaucoma and closed angle glaucoma.
14. Describe the process which causes retinal detachment.
15. List the primary causes of blindness in your country and worldwide.
16. State the primary function of the immune system and the effect of the AIDS virus on the eyes.

### Module II: Pharmacology/Eye Disease II

Credit Hours: 2

#### I. Course Description

Continuation of Pharmacology/Eye Disease I. (See Course Description Pharmacology/Eye Disease I.).

#### II. Course Content, Competencies and Skills

##### A. Introduction to Medications.

1. Define and pronounce vocabulary terms.
2. List and briefly describe the uses, sources, names, classifications, and types of drugs.
3. Interpret abbreviations and commonly used symbols.

##### B. Ophthalmic Drug Identification.

1. Describe proper technique for instillation of topical ophthalmic drops and ointment.
2. List advantages and disadvantages of methods of drug delivery including drops, ointments, sustained release medications, injections, and systemic medications.
3. Explain the technique and rationale of punctal occlusion.
4. Differentiate between mydriatic and cycloplegic medications.
5. Describe four different types of glaucoma medications with an example of each type.
6. List types, strengths, actions, contraindications, and complications of anesthetics, mydriatics and cycloplegics, epinephrine, beta-blockers, miotics, steroids, antibiotics, carbonic anhydrase inhibitors, vasoconstrictors, antihistamines, osmotic agents, and nonsteroidal anti-inflammatories.
7. Demonstrate how to read the doctor's written prescription.
8. Explain first aid techniques for acute ophthalmic drug reactions.

### Module III: Ophthalmic Office Procedures

Credit Hours: 3

#### I. Course Description

Utilization of techniques to obtain medical and ophthalmic history, transcription of information into the medical chart, and common terms and abbreviations used in history taking. Covers front office techniques, including basic functions of a computer in the medical office. Develops skills needed to obtain accurate patient visual acuity.

#### II. Course Content, Competencies and Skills

##### A. Ophthalmic Equipment/Instruments.

1. Identify and explain the use of common ophthalmic equipment.
2. Perform proper cleaning and routine maintenance of ophthalmic equipment.
3. Check calibration of instruments such as keratometer and lensometer.
4. Describe how to implement proper in-office maintenance and repair.
5. Safely change bulbs and fuses on ophthalmic equipment.

##### B. Medical/Ophthalmic History.

1. Describe how to take a complete medical and ophthalmic history.
2. Describe how to provide accurate historical documentation.
3. Describe how to succinctly and efficiently transcribe obtained information into the patient chart.
4. Identify the difference between new and established patients as they relate to documentation.
5. Define "Chief Complaint" and its importance in the medical record.
6. Detail the components of a personal, family, and social history.

##### C. Appointment Scheduling/Telephone Technique.

1. Incrementally scheduling patient appointments to enable physician's office schedule to run smoothly.
2. Appointment triaging to determine when a request for



an appointment should be considered as an emergency. 3. State the reason for recording failed appointments on the patient's chart. 4. Discuss the handling of cancellations and delays brought about by office situations. 5. List and explain the basic guidelines to follow in scheduling appointments. 6. Demonstrate the appropriate method of placing and receiving phone calls. 7. Identify the kinds of calls that need to be referred to the physician for response.

**D. Medical Records Management.**

1. State three important reasons for keeping good medical records. 2. Illustrate the meaning of subjective and objective information in a medical history. 3. Explain the basic differences between traditional and problem-oriented medical records. 4. List the items of personal data needed in a patient medical record. 5. Discuss changing an entry in the medical record and the importance of following correct procedure.

**E. Visual Acuity.**

1. Compare methods of measuring visual acuity in children and adults. 2. Explain methods of near vision testing. 3. Describe the various methods of expressing vision testing for distance and near acuities. 4. Discuss methods to test illiterate and preschool children. 5. Define accommodation. Explain how it is measured and how it affects visual acuity testing. 6. Give indications and procedure for utilizing the Potential Acuity Meter.

**F. Vital Sign Measurement.**

1. List the four components of measuring vital signs. 2. Demonstrate proper measurement of pulse rate, respiration rate, body temperature, and blood pressure. 3. List the normal rate of pulse, respiration, body temperature, and the normal values of blood pressure.

## Module IV: Introduction to Clinical Skills

**Credit Hours: 3**

### I. Course Description

Covers basic test principles and techniques, including the ocular screening exam, visual acuity measurement, slit lamp examination, tear function, and color vision tests. Tonometry, refractometry, and retinoscopy will be reviewed in theory only.

### II. Course Content, Competencies and Skills

**A. Lensometry.**

1. Demonstrate location of the optical center of the lens. 2. Demonstrate measurement of single vision and multifocal spectacles. 3. Demonstrate measurement of spectacles with prism. 4. Discuss the significance of vertex distance.

**B. Introduction to Visual Fields/Amsler Grid.**

1. Define the limits of the visual field. 2. Discuss the "island of vision" analogy. 3. Define visual field terminology including: isopters, threshold, apostilb, decibel. 4. Discuss methods of measuring the visual field. 5. List visual field screening methods. 6. List manual techniques for testing the visual field. 7. List automated methods for testing the visual field. 8. Distinguish the differences between static and kinetic field-testing. 9. Demonstrate Amsler grid, confrontation fields, and tangent screen visual fields.

**C. Estimation of Anterior Chamber Depth.**

1. Demonstrate the technique for estimation of the ante-

rior chamber depth using both penlight and slit lamp screening methods. 2. List the estimation grading scale.

**D. Keratometry.**

1. Discuss the technique for measuring the corneal curvature. 2. Define corneal astigmatism. 3. Define "with-the-rule" and "against-the-rule" astigmatism. 4. Demonstrate measurement of corneal curvature using the keratometer.

**E. Advanced History Taking.**

1. List visual tests anticipated for tentative diagnoses such as cataract, open angle glaucoma, esotropia, migraine, etc.

**F. Basic Tonometry.**

1. Discuss the principles and differences between applanation and indentation tonometry, and the advantages and disadvantages of each. 2. Discuss possible errors in tonometry testing. 3. Discuss proper methods of cleaning and disinfecting tonometers. 4. Discuss technique for each method of tonometry. 5. Discuss the methods of assessing scleral rigidity. 6. Name factors altering intraocular pressure. 7. Demonstrate non-contact tonometry and Schiottz tonometry.

**G. Assisting the Patient.**

1. Discuss methods for assisting physically and visually disabled patients. 2. Discuss methods of assisting the physician with children.

**H. Retinoscopy/Refractometry Theory.**

1. Discuss the principles and techniques of retinoscopy. 2. Describe the steps in refractometry, including use of fogging, astigmatic dials, cross cylinder, duochrome tests, and tests of accommodation.

**I. Ocular Mobility.**

1. Demonstrate motility screening tests including cover/uncover and alternate cover tests. 2. Demonstrate phoria and tropia. 3. Demonstrate Krimsky and Hirschberg estimation. 4. Demonstrate use of the Maddox rod, Worth four-dot test, red glass, duction, and version testing. 5. Demonstrate near point of convergence/accommodation. 6. Demonstrate vergence amplitudes. 7. Demonstrate use of the Risley rotary prism.

## Module V: General Medical Terminology Credit Hours: 3

### I. Course Description

Analyze the structure of medical words and apply to basic anatomy, physiology, and disease processes of the human body, stressing spelling and pronunciation.

### II. Course Content, Competencies and Skills

**A. General Concepts of Medical Terminology.**

1. The goal is to understand a given medical term, give its definition by breaking it into component parts, and identifying the body system to which it relates. 2. Students must also understand body structure.

**B. Musculoskeletal System.**

1. Understand the basic anatomical structures, terminology, and functions of the musculoskeletal system. 2. Know basic diseases and pathological conditions commonly encountered in this system.

**C. Circulatory System.**

1. Understand the basic concept of the circulation of blood through the body and its function, and basic pathological disorders of blood and the circulatory system.

**D. Respiratory System.**

1. Understand basic anatomical structures, terminology,



and functions of the respiratory system. 2. Know the basic diseases and pathological conditions commonly encountered in this system.

E. Urogenital and Male Reproductive Systems.

1. Understand the basic anatomical structures, terminology, and functions of the genitourinary system. 2. Know the basic diseases and pathological conditions commonly encountered in this system.

F. Female Reproductive System.

1. Understand the basic anatomical structures, terminology, and functions of the female reproductive system. 2. Know the basic diseases and pathological conditions commonly encountered in this system.

G. Digestive System.

1. Understand the basic anatomical structures, terminology, and functions of the digestive system. 2. Know the basic diseases and pathological processes commonly encountered in this system.

H. Endocrine System.

1. Understand the basic anatomical structure, terminology, and functions of the endocrine system. 2. Know the basic diseases and pathological processes commonly encountered in this system.

I. Nervous System.

1. Understand the basic anatomical structure, terminology, and functions of the nervous system. 2. Know the basic diseases and pathological processes commonly encountered in this system.

J. Sensory System.

1. Understand the basic anatomical structure, terminology, and functions of the sensory system. 2. Know the basic diseases and pathological processes commonly encountered in this system.

K. Skin.

1. Understand the basic anatomical structure, terminology, and functions of the integumentary system. 2. Know the basic diseases and pathological processes commonly encountered in this system.

## Module VI: Practicum I

Credit Hours: 1

### I. Course Description

Introductory clinical work designed for application of technical skills acquired in previous course work. Student will be supervised on-site by an ophthalmic technician. Prerequisite: Students must have completed the first two terms of the OMT program before taking this course.

### II. Course Content, Competencies and Skills

#### A. Front Office/Medical Records Management.

1. Demonstrate proper method of greeting and interviewing patients. 2. Demonstrate ability to handle patient telephone calls appropriately, including triage, and appointment scheduling. 3. Perform routine front office duties such as insurance billing, reception, maintenance, and cashier work. 4. Prepare and demonstrate ability to properly handle medical records (i.e., initiation, filing, charting, content, and purging).

#### B. Medical Ophthalmic History.

1. Take appropriate and complete medical and ophthalmic history. 2. Demonstrate ability to perform adequate historical documentation. 3. Transcribe obtained information into the chart succinctly and efficiently.

#### C. Visual Acuity.

1. Identify methods of measuring visual acuity in adults and children. 2. Demonstrate accurate recording of acuity measurements in the medical record. 3. Demonstrate ability to accurately measure near vision. 4. Define common abbreviations used in recording visual acuity. 5. Operate the lensometer accurately and efficiently.

## Module VII: Clinical Optics I

Credit Hours: 2

### I. Course Description

Introduces mathematics used in optical prescriptions, manufacturing, and dispensing. Basic principles governing transmission of light and its interaction with optical media. Includes experimentation to visually inform the student of the laws of geometric optics.

### II. Course Content, Competencies and Skills

#### A. History of Ophthalmics/Medicine.

1. Explain how optical lenses, spectacles, and contact lenses came to be developed and know some of the associated historical names. 2. Identify the different tasks of opticians, optometrists, ophthalmologists, and ophthalmic medical technicians. 3. Distinguish types of medical practices such as individual private practice, partnerships, group practices, health maintenance organizations, and government programs, as well as ambulatory and outpatient surgical facilities.

#### B. The Specific Knowledge and Tasks of the OMT.

1. Define tasks of an ophthalmic medical technician functioning in an office-based practice or ambulatory surgery center. 2. State the diagnostic tests an ophthalmic medical technician will be expected to perform. 3. List skills necessary to become a certified ophthalmic technician.

#### C. Employment Opportunities.

1. State employment opportunities in an office based practice, multi-specialty clinic, surgical setting, or other related occupations for an Ophthalmic Medical Technician.

#### D. Organizations.

1. Explain what "JCAHPO", "ATPO", and "AAO" stand for, and how these organizations serve Ophthalmic Medical Technicians.

#### E. Physical Description of Models Used to Describe Action of Light.

1. Describe wave fronts, wavelengths, frequency, and speed of light. 2. Define parallel light radiation, convergence, and divergence of light radiation, polarization, diffraction, and dispersion.

#### F. Electromagnetic Radiation Spectrum.

1. Describe wave and particle theories of light. 2. Describe electromagnetic spectrum radiation, visible spectrum radiation, ultra-violet radiation, and infrared radiation. 3. Describe electromagnetic radiation in terms of nanometers. 4. Describe visible spectrum in units of color. 5. Describe and define visible, UV, and IR as wavelengths/frequency of electromagnetic radiation.

#### G. Concepts of Optical Imaging.

1. Define formation of a real image and impossibility of formation of a virtual image. 2. Define and demonstrate image sizes as compared to object sizes (enlarged, same size, minified). 3. Define and demonstrate image states as compared to object states (upright, inverted, and rever-

- ted). 4. Define aberration. 5. Define and list examples of opaque, translucent, and transparent substances.
- H. Basic Mathematics for Optics.
1. Compare measuring units (millimeter, centimeter, meter, and inches).
  2. Demonstrate working with positive and negative numbers (addition, subtraction, multiplication, and division of positive and negative numbers).
  3. Review addition, subtraction, multiplication, and division of fractions.
  4. Demonstrate conversion of fractions to decimals and decimals to fractions.
- I. Basic Lens Terms.
1. Define: meniscus surfaces, plano, spherical, cylinder, and toric surfaces and powers.
  2. Using the words: sphere, cylinder, and toric, describe how lenses may be classified into the following combinations: spherical, spherocylinder, plano-cylinder, and crossed-cylinder.
  3. Define and/or locate the following descriptive points on a lens: optical center, optical axis.
  4. Describe a minus and a plus lens (in terms of center and edge thickness, and in terms of motion and magnification).
  5. Define emmetropia, myopia, hyperopia, ametropia, and presbyopia.
  6. Relate ametropia to corrective lens type.
  7. Define radius of curvature as related to depth of a surface curve of a lens surface.
  8. Compare flat surface curvature to radius number, and steeply curved surfaces to radius number.
  9. Describe synonyms for front and back lens surfaces.
- J. Reflection.
1. Define the basic unit of measurement of dioptric power of a lens.
  2. Define specular (regular) reflection, diffuse (irregular) reflection, angle of incidence, angle of reflection, normal, and plane.
  3. Define/describe law of reflection: angle I = angle R, object plane vs. image plane.
- K. Ray Tracing to Find Image Distances and Characteristics – Curved Surfaces.
1. Find image distances and characteristics when object is at defined distances from the vertex of a concave or convex surface by ray tracing (object at infinity or object at any other distance from vertex).
  2. Give example of reciprocals, showing the focal length of lens in meters can be divided into one to equal diopters, and dioptric power can be divided into one to equal focal length in meters.
- L. Explaining the Prescription (Rx).
1. Define how spherical and cylinder power components of an Rx are combined to find the power produced at right angles.
  2. Define and describe the optical cross as a device to show placement of power on a lens.
- M. Transposition.
1. Explain transposition as technique used to change from one cylinder to another without changing the Rx.
  2. Explain the steps needed to transpose an Rx (algebraically combine sphere and cylinder power, change sign of cylinder number, or change axis number by adding or subtracting 90 degrees).
  3. Demonstrate how optical cross is drawn and how powers are noted.
- N. Prescription Axis Notation and Optical Protractors.
1. Explain why the axis of the toric Rx must be oriented when placed before the eye for proper alignment of optical powers.
  2. Explain how meridians of power relate to Rx toric components.
  3. Explain how the axis of an Rx describes placement of powers and relate axis to the protractor.
  4. State difference between the protractor used by the optical industry, and a normal protractor that is divided into 360 degrees.
  5. Explain that 0 degrees on convex surface of a lens is on the right side, and that 180 degrees on the convex surface is on the left and 90 refers to both top and bottom of the lens.
  6. Differentiate 0 degrees placement on both concave and convex lens surfaces.
  7. Describe how most optical protractors used for marking lenses are marked in red numbers for convex surfaces and black numbers for concave surfaces.
- O. Lens Forms and Base Curves.
1. Explain how front surface curves (base curves) are related in image formation as perceived by the brain.
  2. Use a formula to select a base curve for any Rx.
  3. Discuss magnification as related to base curves.
  4. Discuss ranges of base curves available from lens manufacturers.
  5. Define ANSI standards for base curve tolerance.
- P. Astigmatic Refractive Errors and Prescriptions.
1. Define astigmatic errors.
  2. Define corneal, refractive, residual, and total astigmatism.
  3. Explain corneal topography as related to with-the-rule, against-the-rule, and oblique astigmatism.
  4. Define and write a hypothetical Rx in both plus and minus cylinder for the five classifications of toric prescriptions: simple myopic, compound myopic, simple hyperopic, compound hyperopic and mixed astigmatism.
  5. Discuss the keratometer (ophthalmometer) for measuring corneal curves.
  6. Define unit of measurement by the keratometer of corneal curves in diopters, and/or radius of curvature in millimeters.
- Q. Nominal Power Formula to Find Surface Powers of Rx and Lens Graphs.
1. Explain the nominal power formula's essential items for computations: Rx, front surface power, back surface power.
  2. Use a formula to solve problems for spherical and toric Rx's. Find: Rx, D1 and D2.
  3. Describe and write lens graphs for spherical and toric Rx's.
  4. Describe use of signs for surface powers on the lens graph.
  5. Explain on plus lenses why the absolute power of D1 surface is always higher (larger number).
- R. Lensometer.
1. Demonstrate correct eyepiece setting procedure.
  2. Measure spherical and toric lenses and multifocal additions.
  3. Read the power of toric lens in minus and plus cylinder form.
  4. Write the neutralized power of toric lenses readings in plus and minus cylinder forms.
  5. Position the optical center of lenses according to: Rx with no prism and mark, and Rx with prism and mark.
  6. Replace light bulbs in a lensometer.

## Module VIII: Clinical Optics II

Credit Hours: 2

### I. Course Description

Continues the study of advanced optical mathematics, geometric optics including prisms, ray tracing, lens aberrations, and formulas for finding image distances. Effective use of lensometers, radius/diopter formulas, multifocal prescriptions, and power calculations.

### II. Course Content, Competencies and Skills

#### A. Refraction.

1. Define basic terms used in the geometry of refraction including: parallel, intersection, perpendicular, normal, diverging/converging, angle of incidence, and angle of refraction.
2. Relate index of refraction to refractive power of ophthalmic lens materials.
3. Define and describe use-

- fulness of Snell's Law. 4. Solve refractive index problems mathematically using Snell's law. 5. Graph and compare angles of incidence vs. angle of refraction using various index materials.
- B. Prisms and Refraction Through Prisms.  
1. Describe prism shape. 2. Locate base and apex of a prism. 3. Locate and describe images as seen through prisms. 4. Describe direction of refraction through a prism. 5. Using Snell's law, mathematically predict angle of refraction through prisms.
- C. Refraction Through Simple Plus and Minus Lenses.  
1. Define, describe and/or locate the following terms: focal lengths, vertex point/optical center, axis line, object/image distance, optical center, image characteristics, virtual/real, magnified/same size/minified. 2. Describe nature and characteristics of images formed by negative lenses when object is any distance from lens. 3. Describe nature and characteristics of images formed by positive lenses when object is at: infinity, 1/2, 1, 2, 3 times the focal length of the lens.
- D. Lensmaker's Equation.  
1. Describe usefulness of Lensmaker's equation. 2. Describe accuracy of using Lensmaker's equation for high plus lenses. 3. Describe/define component parts of Lensmaker's formula:  $R_1$ ,  $R_2$ ,  $n$ ,  $F$ . 4. Mathematically solve Lensmaker's equation problems.
- E. Defects of Imaging Through Lenses.  
1. Define spherical and chromatic aberration. 2. Define astigmatism of oblique incidence. 3. Define distortion.
- F. Radius of Curvature and Diopter Conversion-Marked Power and True Power.  
1. Describe two properties that help decide what power a lens surface will produce. 2. Define index of refraction. 3. Define surface curvature. 4. Define marked power or index 1.530 (industrial standard index). 5. Name instruments/calculations that use industrial standard index. 6. Describe how lens material indexes other than 1.530 will create an important difference in diopter curve or true power of the surface. 7. Use a formula to convert diopters to radius of curvature in millimeters. 8. Use a formula to convert radius of curvature to diopters.
- G. The Near Addition-Bifocals, Trifocals, and Presbyopia.  
1. Recognize presbyopia by inclusion of additional power to an Rx, or listening to patients' visual complaints. 2. Algebraically, calculate a near or intermediate Rx from patients Rx's. 3. Using the lensometer, neutralize near or intermediate Rx. 4. Define fused and one-piece multifocals. 5. Give examples of fused and one-piece multifocals as related to lens material. 6. Define intermediate power as a percentage of near power. 7. Write ANSI standards for addition power. 8. Discuss importance of gathering information concerning patients near and intermediate visual needs.
- H. The Boxing System of Frame Measurements.  
1. Discuss frame markings for sizing. 2. Define the following terms and give synonyms for: "A", "B", "ED", "DBL", and "FPD." 3. Explain how the optician checks frame measurements. 4. Define Major Reference Point (MRP). 5. Explain MRP and optical center (OC) differences. 6. Define lateral and vertical decentration of MRP in finishing of single vision lenses and multifocals. 7. Define total decentration.
8. Write and define ANSI standards for MRP, segment distances and heights.
- I. Vertex Power Changes and Compensation for Positional Changes:  
1. Define vertex distance. 2. State at what powers or conditions positional compensation for Rx must be considered. 3. State "usual" refraction distance. 4. Discuss "rule" about lenses losing plus power as vertex distance decreases. 5. Use a chart to find effective power of new Rx. 6. Use a formula to find effective power of new Rx.
- J. Ophthalmic Prism.  
1. Review prism, apex/base designation, and direction of light and images seen through prisms. 2. Discuss prism use in refractive examinations. 3. Define orthoptics and use of prism lenses. 4. Define prism diopter. 5. Define Prentice's Rule (prism = decentration in cm x Rx, Decentration in cm = prism/Rx, Rx = prism/decentration in cm). 6. Figure base direction for plus or minus lenses when the optical centers of lenses are not directly in front of the patient's pupils. 7. Figure amount of prism in any (necessary) meridian of a lens. 8. Use the lensometer to check for unwanted or prescribed prism. 9. Define anisometropia. 10. Define bicentric or slab-off grinding. 11. Using the formula, figure the amount of wanted slab-off prism. 12. Know the limitations of bicentric grinding and pre-molded slab-off lenses. 13. Use a lens clock for checking accuracy of bicentric grinding. 14. Define and discuss reasons for splitting a prism. 15. Define compound and resolving prisms. 16. Use a formula, charts and/or nomogram for compounding prisms. 17. Use a chart or a formula to compute thickness differences induced by a prism. 18. Describe some effects of unwanted prisms.
- K. Thick Lens Equations.  
1. Define the following terms: front vertex power, back vertex power, and index of refraction. 2. Define use of nominal lens power formula accuracy and thick lens power formula accuracy. 3. Using formulas, solve thick lens power problems.
- L. Ophthalmic Dispensing.  
1. Describe the materials used to make ophthalmic frames and list the advantages and disadvantages of each. 2. Describe the process of frame selection, cosmetic considerations, interpretation of a prescription, and measurements that are necessary. 3. Identify various tools used for dispensing. 4. Explain the use of salt pans in dispensing, and techniques for adjusting frames to avoid damage. 5. Define lensometry, its application with single vision lenses, multifocal lenses, and prisms. 6. Compare the techniques for measuring multifocal lenses and prismatic lenses. 7. State the uses and techniques of the lens clock and vertometer. 8. Explain the various tints and coatings common to ophthalmic lenses.

## Module IX: Ocular Anatomy & Physiology

Credit Hours: 2

### I. Course Description

Relates structure and function of the human visual system. Anatomy and physiology of the eyeball, orbit, and ocular adnexa are covered. Special emphasis placed on ocular terminology.

## II. Course Content, Competencies and Skills

### A. Orbit and Adnexa.

1. Locate and describe the shape and function of the orbit.
2. Identify the seven bones of the orbit.
3. Identify the three openings into the orbit from the cranial vault.
4. List the vessels that course through each of the three openings.
5. List and locate the four sinuses that surround the orbit.
6. Describe the nerve fibers that flow through the ciliary ganglion.
7. Locate the origination of ocular muscles in the orbit.
8. Locate and describe the function of the optic nerve.
9. Locate and describe the geographical landmarks as related to the upper and lower eyelids, including canthi and palpebral fissures.
10. Describe the general functions of the eyelids.
11. List in order the pre-corneal tear film layers.
12. Locate the main lacrimal glands, Meibomian glands, and Goblet cells and describe the general purpose of fluids secreted by each.
13. Locate and describe the collection system for tear film including puncta, canaliculi, and lacrimal sac.
14. Define and explain the role of the enzyme lysozyme.
15. Name and locate the bulbar and palpebral conjunctiva and fornix.
16. Describe conjunctival tissues.
17. Locate and define Tenon's Capsule.
18. Name the six muscles responsible for ocular movements.
19. Locate the insertion points of the ocular muscles on the globe.
20. Locate and describe the trochlea.
21. Define adduction and abduction, elevation and depression, and intortion and extortion.
22. Locate and describe the function of the cilia and brows.

### B. General Dimensions and Descriptions of the Human Eye.

1. Describe the location of the equator of the globe.
2. Locate the anterior and posterior poles of the globe.
3. Describe the average diameter of the eye between the anterior and posterior pole in inches and millimeters.
4. Define and locate the visual axis of the globe.
5. Name three coats of the eye.
6. Describe the average front surface power of the cornea in diopters and millimeters of radius.
7. State the refractive index of the cornea.
8. List the chambers found within the eye.
9. List the structures found within each chamber.

### C. Cornea and Sclera.

1. Describe the vascular state of the normal cornea.
2. Describe the thickness of the cornea centrally and peripherally.
3. Name the sources of oxygen and oxygen requirements of the cornea.
4. Describe normal corneal sensitivity.
5. Name each layer of the cornea and its regenerative qualities.
6. Describe the types of cells in the epithelium.
7. Describe the source of oxygen and nutrition of the endothelium.
8. Describe the normal pH of tear chemistry.
9. Locate the limbus and describe the limbal blood supply.
10. Locate and describe the average width of the corneal scleral limbus.
11. Locate and describe the function of the sclera and lamina cribrosa.

### D. Vascular Layer (Uvea).

1. Locate and describe the iris, ciliary body, and choroid.
2. Define melanin vs. iris color.
3. Describe the ciliary process and formation of aqueous humor.
4. Describe normal intraocular pressure and tonometry.
5. Locate and describe the aqueous drainage system including: "angle", trabecular meshwork, and Schlemm's canal.
6. Locate and describe the ciliary muscles, suspensory ligaments, and layers of the crystalline lens and accommodation.
7. Define amplitude of accommodation vs. age.
8. Describe pupillary

action during accommodation.

9. Describe the action of the dilator and sphincter muscles.
10. Describe the direct and consensual light reflex.

### E. Retina.

1. Locate the retina and describe its general function.
2. Locate and describe the optic nerve, macular lutea, fovea centralis, central retinal artery, and ora serrata.
3. Describe the visual pathway from the retina to the occipital cortex.
4. Locate and describe the function of the chiasm.
5. List the ten layers of the retina.
6. Locate and describe the general function of the pigment epithelium.
7. Locate and describe rod and cone function.
8. Describe photopic and scotopic vision.

## Module X: Diagnostic Procedures I

Credit Hours: 4

### I. Course Description

Introduction to fundamentals of diagnostic testing and techniques including: applanation and Schiottz tonometry and biomicroscopy. Presents principles and techniques of refractometry and retinoscopy, with emphasis on skill development utilizing the schematic eye.

### II. Course Content, Competencies and Skills

#### A. Tonometry/Biomicroscopy.

1. Describe the contrast between different tonometers.
2. Explain how to use each tonometer.
3. Outline an approach for accurate tonometry.
4. Decide which instrument to use to accomplish the measurement with greatest accuracy, efficiency, and least amount of discomfort to the patient.
5. Explain the principles of applanation tonometry and indentation tonometry.
6. Describe the selection of proper disinfection techniques for tonometers.
7. Calibrate and disinfect each type of instrument.
8. Perform applanation, non-contact, and indentation tonometry.
9. Outline the advantages and disadvantages of each method of tonometry.
10. Perform and record results of the flashlight test.
11. Utilize biomicroscopy to perform an anterior segment and ocular adnexa examination.

#### B. Retinoscopy and Refractometry.

1. State and explain the principles of and indications for retinoscopy and refractometry.
2. Describe the mechanism and functioning of the streak retinoscope.
3. Describe the various types of behavior of the retinoscopic streak.
4. Explain the recording of retinoscopic results and transpose those results into spherocylindrical form.
5. Perform retinoscopy on the schematic eye.
6. Perform retinoscopy on the human eye.
7. Demonstrate appropriate maintenance of various phoropters and retinoscopes.
8. Differentiate between refraction and refractometry.
9. Describe subjective and objective methods of measuring refractive error.
10. Explain the refinement technique using a cross cylinder lens.

## Module XI: Diagnostic Procedures II

Credit Hours: 4

### I. Course Description

Presents principles and techniques of various methods of visual field examination. The visual pathway, common causes of visual field loss, and related anatomy will be covered with emphasis on Goldmann perimetry. Also covers principles and techniques of exophthalmometry, color vision, and tear function tests. Emphasis is placed on skill development.



## II. Course Content, Competencies and Skills

### A. Visual Fields.

1. Name and describe the anatomical structures of the visual pathway. 2. Demonstrate visual field screening techniques. 3. Demonstrate and properly record a confrontation field-test. 4. Perform and properly record an Amsler Grid test. 5. Relate visual field loss to specific ocular dysfunction/pathology. 6. Perform a tangent screen visual field according to standard procedure and in a timely manner. 7. Perform a Goldmann visual field examination with emphasis on correct procedure for selecting stimulus and correcting lens power, plotting isopters, finding defects, and investigating visual field loss. 8. Calibrate the Goldmann perimeter. 9. Describe common visual field artifacts and their causes. 10. List common visual field defects from: retinal disease, optic nerve disease/glaucoma, and neurological disease.

### B. Exophthalmometry, Color Vision, Tear Function.

1. Perform measurement of proptosis using a Hertel exophthalmometer. 2. Demonstrate color vision testing using Ishihara test plates. 3. Demonstrate color vision testing using the Farnsworth-Munsell D-15 test. 4. Name alternate methods of color testing. 5. Take a history relevant to identifying a possible “dry eye” patient. 6. List the steps to perform Schirmer tear test I and II. 7. Define and demonstrate a tear film “breakup time” test.

## Module XII: Ocular Motility

Credit Hours: 2

### I. Course Description

Introduction to ocular motility and binocular vision. Emphasis is placed on understanding the presentation, characteristics, and natural history of the strabismus patient. Amblyopia and binocular vision are addressed.

### II. Course Content, Competencies and Skills

#### A. Extraocular Muscles/Strabismus.

1. Name the extraocular muscles and their function. 2. Take a relevant history for a strabismus workup. 3. Describe how to perform the basic measurement procedures in the screening examination of a strabismic patient. 4. Describe cover/uncover test, alternate cover test, and Krimsky and Hirschberg tests. 5. Distinguish between phoria and tropia. 6. Distinguish between ductions, versions, and vergences. 7. Describe the diagnostic positions of gaze. 8. Explain the object of motility testing and why binocular function is important. 9. Explain fusion, diplopia, and suppression. 10. Describe use of the Maddox rod, Worth four-dot, red glass, and Bagolini lenses in testing for fusion. 11. Describe various methods of assessing visual acuity and their significance in strabismus. 12. Describe how to perform vision screening in preschool children using appropriate testing methods for the age. 13. Describe the physiologic mechanisms (motor and sensory) implicit in strabismus management. 14. Describe the role of surgical vs. medical (including orthoptic) management of strabismus. 15. Describe the characteristics, presentation, and natural history of pseudostrabismus, congenital esotropia, accommodative esotropia, and intermittent deviations. 16. Distinguish between comitant and incomitant deviations. 17. Discuss the significance of primary and secondary deviations. 18. Define restrictive strabismus and describe the various types.

### B. Amblyopia.

1. Define amblyopia. 2. Describe the types of amblyopia and methods for detection. 3. Name the tests that may be necessary to diagnose amblyopia. 4. Distinguish possible treatment methods for amblyopia.

## Module XIII: Surgical Assisting Procedures

Credit Hours: 3

### I. Course Description

Addresses the ophthalmic technician's role in minor office surgery and assisting in the operating room. Topics covered include: proper aseptic technique, scrubbing, gowning and gloving, sterilization of instruments, the importance of surgical conscience/legal responsibilities, proper disposition of supplies/medications, and security procedures of medications as regulated by law.

### II. Course Content, Competencies and Skills

1. List methods of disinfecting and sterilization. 2. Demonstrate how to prepare items for sterilization. 3. Explain guidelines for packing and loading the sterilizer. 4. Describe operation room sanitation procedures. 5. List sources of contamination and infection control measures. 6. Define principles of aseptic technique. 7. Demonstrate practical applications of sterile techniques. 8. Outline methods of opening and distributing sterile goods. 9. Define terminology associated with asepsis and sterile techniques. 10. Review historical concepts and background of infection control. 11. Describe types of operating room attire. 12. Describe the surgical scrub procedure. 13. Demonstrate gowning and gloving of self and others. 14. Define and demonstrate the procedure for removing gown and gloves aseptically. 15. Demonstrate positioning of patients for ophthalmic procedures. 16. List steps in anesthesia preparation and frequently used eye medications. 17. Define intraoperative care. 18. Perform preparation of the eye and face for surgery. 19. Demonstrate the general principles of draping. 20. Describe equipment and supplies used in ophthalmic procedures. 21. Define the types and sizes of eye suture materials and needles. 22. Outline suggested basic and emergency eye instrument trays. 23. Describe medications used in eye procedures. 24. Describe the proper method to inventory clinical supplies and medications. 25. Define safety/security procedures regarding disposition of medications. 26. Classify medication as to shelf life/expiration dates. 27. Demonstrate techniques for cleaning instruments in the operating room. 28. State the steps in preparing a set of instruments. 29. State the steps in cleaning and sterilizing instruments. 30. Describe how to process a micro eye tray. 31. Define the proper care of gem blades. 32. State ways to store surgical instruments. 33. Define a qualified maintenance and troubleshooting program. 34. List the steps for admitting a surgical patient to the hospital. 35. List the steps necessary to prepare a child and their parent for surgery. 36. Describe how to prepare an adult for major surgery. 37. Identify questions commonly asked by patients regarding ocular surgery. 38. Discuss the various types of anesthesia for ocular surgery. 39. State the technician's role in the care of a postoperative patient. 40. List the four components of measuring vital signs. 41. Demonstrate proper measurement of pulse rate, respiration rate, body temperature, and blood pressure. 42. List the normal rate of pulse, respiration, body temperature, and the normal values of blood pressure.

43. Describe how ophthalmic lasers work. 44. Define the types of lasers. 45. List advantages of laser surgery. 46. State necessary safety precautions with laser use. 47. Define the role of the ophthalmic medical technician when the laser is used.

## Module XIV: Therapeutic Assisting Procedures

Credit Hours: 4

### I. Course Description

Focus on the technician's role in assisting in the management of preoperative and postoperative patients. More advanced ophthalmic procedures include ultrasound, potential acuity meter, direct ophthalmoscopy, and contrast sensitivity. Specimen collection for the laboratory is addressed.

### II. Course Content, Competencies and Skills

#### A. Echography.

1. List the classifications of ultrasound. 2. Explain terminology related to echography. 3. Describe clinical applications of diagnostic ultrasound. 4. List the steps necessary to measure the axial length of an eye. 5. List the methods of performing diagnostic B-scans. 6. List the methods to prepare a patient for a diagnostic B-scan. 7. Name the components of ophthalmic ultrasound instrumentation. 8. List the methods available to document ultrasound images. 9. Demonstrate proper maintenance of ultrasound equipment. 10. Define corneal thickness and list the steps necessary to perform pachymetry. 11. Define standardized echography. 12. Demonstrate proper labeling of echograms. 13. State the effects of corneal power, lens power, and overall length of the eye on IOL calculations. 14. Calculate an accurate IOL lens power.

#### B. Advanced Ophthalmic Procedures.

1. Demonstrate proper examination techniques using a direct ophthalmoscope. 2. Perform a contrast sensitivity test. 3. Perform and score a 100-Hue test.

#### C. Microbiology.

1. Identify terms and definitions of microbiology. 2. Describe the types of bacteria commonly seen in ophthalmic practice. 3. Describe the ocular viruses. 4. State the methods for collecting cultures and inoculation techniques. 5. List the steps required to obtain a conjunctival culture. 6. List the steps required to obtain a lash margin culture. 7. List the steps required to obtain a corneal/conjunctival scraping.

#### D. Photography.

1. Identify terms and definitions of basic photography (including film, exposure, focal length, depth of field, synchronization, beam splitters, reticles, ocular, focus, video, and astigmatic correction). 2. List the steps required to perform fundus photography. 3. Identify photographic defects/artifacts. 4. Describe the relationships among shutter speed, aperture number, and film speed. 5. Define the relationship between ISO/ASA film rating, and film sensitivity. 6. Differentiate between digital, fluorescein, and indocyanine green angiograms. 7. List major indications for fluorescein angiography. 8. List contraindications of angiography. 9. List mild and major reactions to fluorescein injection. 10. List treatments for adverse reactions.

## Module XV: Content Lens I

Credit Hours: 3

### I. Course Description

Covers fundamentals of contact lens. Principles of lens structures, materials used in manufacturing, categorization, and comparison of characteristics of soft and rigid lenses. Includes theory and utilization of instruments commonly used in fitting and assessing contact lenses. Includes use of keratometer, biomicroscope, radiuscope, lensometer, gauges, loupes, magnifiers, and fluorescent tubes.

### II. Course Content, Competencies and Skills

- A. Describe the Basic Principles of Fitting the Major Types of Contact Lenses.
- B. Describe and Perform These Fitting Procedures Utilizing:
  1. Keratometry. 2. Corneal diameter. 3. Pupil diameter. 4. Tear secretion. 5. Eyelid tightness. 6. Fluorescein pattern. 7. Spectacle blur. 8. Over-refraction. 9. Pediatric patients. 10. Contraindications.
- C. Describe Patient Instruction For:
  1. Insertion. 2. Removal. 3. Cleaning. 4. Storage. 5. Hygiene. 6. Solutions. 7. Wearing time.

## Module XVI: Content Lens II

Credit Hours: 3

### I. Course Description

Continuation of Contact Lens I. Covers fitting theories and principles for soft and rigid contact lenses, solutions for care and maintenance, dispensing, patient education, post fitting observations, and theories on fitting keratoconus and bifocal contact lenses. Lab activities will allow for observation of physical properties and fitting challenges of contact lenses.

### II. Course Content, Competencies and Skills

1. Perform contact lens modifications. 2. Perform vision assessment. 3. Perform verification of lens power, base curve, diameter, central thickness, and edge profile. 4. List the ANSI standards for contact lens tolerances. 5. Describe patient assessment and follow up procedures including indications/contraindications, medications, charting, follow up, re-ordering, and disposable lenses.

## Module XVII: Practicum II

Credit Hours: 4

### I. Course Description

Introductory clinical work designed to apply technical skills acquired in previous course work. Student will assist patients in all phases of care including performance of advanced ophthalmic testing procedures. Student will be supervised on-site by an ophthalmic technician. Prerequisite: Practicum I.

### II. Course Content, Competencies and Skills

- A. Front Office/Medical Records Management.
  1. Demonstrate proper method of greeting and interviewing patients. 2. Demonstrate ability to handle patient telephone calls appropriately, including triage and appointment scheduling. 3. Perform routine front office duties such as insurance billing, reception, maintenance, and cashier work. 4. Prepare and demonstrate ability to properly handle medical records (i.e. initiation, filing, charting, content, and purging).
- B. Medical/Ophthalmic History.
  1. Take an appropriate and complete medical and ophthalmic history. 2. Demonstrate ability to perform adequate historical documentation. 3. Transcribe obtained information into the chart succinctly and efficiently.



- C. Visual Acuity.
1. Identify methods of measuring visual acuity in adults and children.
  2. Demonstrate accurate recording of acuity measurements in the medical record.
  3. Demonstrate ability to accurately measure near vision.
  4. Define common abbreviations used in recording visual acuity.
  5. Operate the lensometer accurately and efficiently.
- D. Visual Fields/Tangent Screen/Amsler Grid.
1. Demonstrate static and kinetic perimetry.
  2. Demonstrate performance of manual and automated perimetry.
  3. Define isopter, scotoma, depression, contraction, central threshold target, and suprathreshold perimetry.
  4. Demonstrate methods for exploring defects with manual perimetry.
  5. Relate visual field loss to specific ocular dysfunction/pathology.
  6. Demonstrate the performance and properly record a confrontational field test.
  7. Explain quantification of scotomas and depressions.
  8. State four advantage of automated perimetry.
  9. Identify which size stimulus on a Goldmann perimeter is equivalent to the usual test stimulus on a Humphrey Field Analyzer.
  10. Perform a Goldmann visual field examination with emphasis on correct procedure for plotting isopters, finding scotoma, and investigating visual field loss.
  11. Perform a Tangent screen (if available).
  12. Properly calibrate a Goldmann perimeter.
  13. Demonstrate, instruct, and perform an Amsler Grid.
- E. Tonometry/Biomicroscopy.
1. Perform non-contact tonometry.
  2. Perform applanation tonometry with a Tonopen.
  3. Clean and calibrate a Schiøtz tonometer (if available).
  4. Estimate anterior chamber depth with the flashlight.
  5. Evaluate pupillary reaction.
  6. Perform biomicroscopy of the anterior segment and ocular adnexa.
- F. Exophthalmometry, Color Vision, Tear Function.
1. Perform measurement of proptosis using a Hertel exophthalmometer.
  2. Demonstrate color vision testing using Ishihara test plates.
  3. Name alternate methods of color vision testing.
  4. Take a history relevant to identifying a possible dry eye patient.
  5. Perform Schirmer tear test I and II.
  6. Define and demonstrate a tear breakup time test.

### Module XVIII: Practicum III Credit Hours: 4

#### I. Course Description

See Course Description Practicum II. Prerequisite: Practicum II.

#### II. Course Content, Competencies and Skills

- A. See Course Content, Competencies and Skills Practicum II.
- B. Surgical Patient Care.
1. Perform all steps necessary to admit a patient to the hospital.
  2. Explain the surgical experience to a child and parents.
  3. Prepare an adult for ocular surgery.
  4. Answer questions commonly asked by patients regarding their ocular surgery.
  5. Identify the various types of anesthesia used during ocular surgery.
  6. Properly complete all paperwork necessary for outpatient or inpatient surgery.
  7. Demonstrate the technician's role in the care of the postoperative patient.
- C. Echography.
1. Explain the ultrasound procedure to a patient.
  2. Prepare the equipment for the procedure.
  3. Instill drops in the

patient's eye if necessary.

4. Measure a patient's axial length.
5. Set up and assist in a diagnostic B-scan.
6. Demonstrate methods to document ultrasound.
7. Maintain ultrasound equipment properly.
8. Explain pachymetry and perform the measurement of corneal thickness.
9. Label echograms in an accepted manner.
10. Calculate an IOL power accurately.

#### D. Advanced Ophthalmic Procedures.

1. Perform a potential acuity meter test on a patient and accurately document the findings.
2. Perform direct ophthalmoscopy on a patient and record the findings.
3. Perform a contrast sensitivity test on a patient and record findings.

#### E. Microbiology.

1. Select the proper medium for transport of ocular specimens.
2. Demonstrate the proper method for collecting cultures.
3. Demonstrate the steps necessary to obtain a conjunctival culture.
4. Demonstrate and explain the steps in obtaining a lash margin culture.
5. Demonstrate and explain the steps in obtaining a conjunctival scraping.
6. Demonstrate and explain the steps in obtaining a corneal scraping.

### Module XIX: Practicum IV

Credit Hours: 4

#### I. Course Description

See Course Description Practicum III. Prerequisite: Practicum III.

#### II. Course Content, Competencies and Skills

See Course Content, Competencies and Skills Practicum III.

### Module XX: OMT Seminar I

Credit Hours: 1

#### I. Course Description

Review major professional subject areas. Discussion of clinical practicum experiences, including concerns, issues, case studies, and procedures. Use videos and lecture to explore ethics, patient confidentiality, and CPT coding. Discuss the history of your country's healthcare as well as current trends in healthcare.

#### II. Course Content, Competencies and Skills

- A. History of Health Care in Your Country.
1. Highlight a brief chronological history of medicine.
  2. Describe historical developments, which currently influence the health care field.
  3. Distinguish types of medical practices such as individual private practices, partnerships, group practices, health maintenance organizations, and government programs.
- B. Medical Ethics.
1. Define common terms in the science of ethics.
  2. Define courtesy, ethical, and legal concepts.
  3. Explain the principles of ethics of the Medical/Ophthalmological Societies in your country.
  4. Define principles involved in ethical care of patients.
  5. Describe law/policies for the control, use, and release of health information, including corrective lens and contact lens prescription.
  6. Specify procedures for insuring the confidentiality of health information.
  7. Describe procedures for insuring security of computerized information.
  8. Respond ethically to requests for patient information.
  9. Define informed consent and explain its importance.
  10. Discuss patient confidentiality and define the professional's role in maintaining confi-

dentiality. 11. Identify various torts in medical practice and explain the consensual nature of the physician-patient relationship.

C. Procedural/Diagnostic coding.

1. Explain the use of ICD-9 and CPT in translating physician services to insurers (if applicable).
2. Describe the common CPT codes used in ophthalmology (if applicable).
3. Define the technician's role in office and surgical coding.

### Module XXI: OMT Seminar II

Credit Hours: 2

#### I. Course Description

Discussion of clinical practicum experiences including concerns, issues, case studies, and procedures. Discuss challenges confronting practitioners and the presentation of new material in the field. Course will include field trips and guest speakers on topics of interest.

#### II. Course Content, Competencies and Skills

1. Employment opportunities in the ophthalmic field.
2. Emerging job markets in ophthalmology.
3. Associated areas of employment - research, eye bank, pharmaceutical, and technical training.

### Module XXII: OMT Seminar III

Credit Hours: 2

#### I. Course Description

See Course Description OMT Seminar II.

#### II. Course Content, Competencies and Skills

See Course Content, Competencies and Skills OMT Seminar II. In addition: 4. ResumÖ preparation, interview techniques.

### Module XXIII: OMT Seminar IV

Credit Hours: 2

#### I. Course Description

See Course Description OMT Seminar II.

#### II. Course Content, Competencies and Skills

See Course Content, Competencies and Skills OMT Seminar II.

### Module XXIV: Perception & Low Vision

Credit Hours: 2

#### I. Course Description

Introduction to basic and advanced visual aids, and their application to patients with various forms of low vision. Covers theories of visual perception, including depth perception, color vision, optical illusion, and how lenses affect perception.

#### II. Course Content, Competencies and Skills

1. Explain the difference between "learned" vs. "innate" visual perception.
2. Explain how culture and environment can influence what an individual perceives.
3. Explain how the brain organizes and adapts to stimulus.
4. Identify brain functions that take place as stimuli are received.
5. Explain the organization principles that interpretation of visual stimulus are based upon, including: figure ground, closure, proximity, similarity, perceptual sets, and constancy.
6. Explain how the brain can be "fooled" by visual illusions.
7. Explain how binocular disparity, corresponding points, and fusion work together to help us see the world in three dimensions.
8. Explain what cues are available to the monocular (and binocular) individual for determining distance.
9. Explain how focus and constancy scaling work to help humans determine the size of objects.
10. Explain how the

image-retina system works to produce perception of movement. 11. Explain how the eye-head system works to produce perception of movement. 12. Explain the principles involved in cinema and television being able to give the illusion of movement. 13. Explain a retinal after-image. 14. Explain what the "phi phenomenon" is. 15. Explain the difference between scotopic and photopic vision. 16. Explain what causes different degrees of color deficiencies and color blindness in different individuals. 17. Explain the color-opponent theory of color perception. 18. Demonstrate negative after-images. 19. Explain how tinted lenses can affect our perception of color and detail. 20. Explain some of the problems caused by putting corrective lenses in front of our eyes, including aniseikonia and diplopia. 21. Explain how increasingly better lens designs are able to alleviate many visual perception problems. 22. Explain how iseikonic lenses are designed to alleviate aniseikonia. 23. Explain how bicentric lenses are designed to alleviate diplopia. 24. Explain how prism lenses are used to alleviate diplopia. 25. Explain what it means to be legally blind. 26. Explain low vision. 27. Demonstrate some of the problems encountered by low vision patients trying to navigate in the world. 28. Describe diseases of the eye that can cause low vision. 29. Explain how magnification is related to dioptric power and in what way magnification increases relative size. 30. Describe different types of hand-held and stand magnifiers, and how they can be used to help some low vision patients. 31. Explain the importance that increased lighting plays for those with low vision problems. 32. Describe different types of spectacle aids for low vision. 33. Describe some of the advantages and disadvantages of projection magnifiers for low vision patients.

### RESOURCES: Books, Videotapes, CD-ROMs



1. American Academy of Ophthalmology. *Introducing ophthalmology: a primer for office staff*. 2 ed. San Francisco: American Academy of Ophthalmology, 2002
2. American Academy of Ophthalmology. *Preferred practice pattern: [multiple subjects]*. San Francisco: American Academy of Ophthalmology, 2002
3. American Academy of Ophthalmology. *The academy guide to on-site medical staff training*. San Francisco: American Academy of Ophthalmology, 1996
4. Cassin B. *Fundamentals for ophthalmic technical personnel*. Philadelphia: W.B. Saunders, 1995
5. Cassin B, Rubin ML. *Dictionary of eye terminology*. 4th ed. Gainesville, Fla.: Triad Pub. Co., 2001: 286
6. Corboy JM. *The retinoscopy book: an introductory manual for eye care professionals*. 5th ed. Thorofare: Slack, 2003; xii: 141
7. Joint Commission on Allied Health Personnel in Ophthalmology. *JCAHPO Learning Systems Modules 1 – 6 (Computer-based skill areas simulation programs)*. St. Paul: Joint Commission on Allied Health Personnel in Ophthalmology, 2004
8. (Multiple Authors). *Clinical skills DVD/videotapes [multiple subjects]*. San Francisco: American Academy of Ophthalmology; Reviewed for currency 2004
9. (Multiple Authors). *The basic bookshelf for eyecare professionals [multiple subjects]*. New Jersey: Slack, 1998

10. Newmark E. Ophthalmic medical assisting: an independent study course. 4th ed. San Francisco: American Academy of Ophthalmology, 2006; xviii: 350
11. Physicians' desk reference for ophthalmic medicines 2006. 34th ed. Montvale: Thomson PDR, 2006: 291. Updated annually.
12. Stein HA, Slatt BJ, Stein RM. Ophthalmic terminology: speller and vocabulary builder. 3rd ed. St. Louis: Mosby, 1992; xiv: 378
13. Stein HA, Stein RM, Freeman MI. The ophthalmic assistant: a text for allied and associated ophthalmic personnel. 8th ed. Philadelphia: Elsevier Mosby, 2006; xviii: 871

### Ophthalmic Allied Health Personnel Self-Study Course Programs

1. American Academy of Ophthalmology, PO Box 7424, San Francisco, California 94109, USA.
2. Centennial College, PO Box 631, Station A, Scarborough, Ontario, M1K 5E9, Canada.
3. Southern Alberta Institute of Technology, 1301 – 16th Avenue NW, Calgary, Alberta, T2M 0L4, Canada.