



**School of Rehabilitation**

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**Course Description Guide**

**Islamic Republic of Iran**

**Ministry of Health, Treatment & Medical Education**



**Tehran University of Medical Sciences & Health Services**

**School of Rehabilitation**

**PhD, Optometry Program**

**2025**

## **Introduction**

The field of Optometry was formed in the USA in 1902, and then expanded in the world according to the development and advancement of technology. Currently, Optometry admits students up to Ph.D. level in the USA, England, Canada, Australia, New Zealand, India, Philippines, etc.

The field of optometry in Iran has been established since 1974 at the undergraduate level and has accepted students at the master's level since 2002. It is natural with having several vision science courses today in the fields of 'machine vision' technology to the vision of athletes, reading and writing disorders, prevention of visual disorders and rehabilitation and management of eye and vision disorders and low vision; It has presented important fields of education and research, and hence, responds to the needs of the society. Among the visual sciences, the field of optometry has established its position and is of special importance.

The term optometry is derived from the word Optos meaning eye and the word Metria meaning measurement, and this name indicates areas of activities of this field. According to the classification of vision sciences among strategic sciences and to the existing strategic documents such as Iran's document 2025, comprehensive scientific map, comprehensive health map, evolution document of medical sciences education, and the like, dealing with this field is a priority. Therefore, the drafting committee of this program submitted an initial draft to the Supreme Planning Council of Medical Sciences, and after completion in numerous specialized meetings and approval by the Supreme Council of Medical Sciences Planning, it has been submitted to the executive universities of medical sciences for implementation. The program drafting committee welcomes the opinions of experts.

### **Name and Definition of the Field and the Relevant Level:**

#### **Name and Level: Specialized Doctorate (Ph.D.) in the Field of Optometry**

#### **Definition of the field:**

Specialized doctorate (Ph.D.) in Optometry is one of the fields of medical sciences whose graduates study and research the latest scientific achievements in the fields of diagnostics, vision protection, and prevention of vision disorders and timely rehabilitation of people affected by visual impairments, and management of designing optometry equipment and applying them.

## **Terms and conditions for admission to the program**

Possessing a master's degree in Optometry.

The exam materials and their ratios are as follows:

Exam Materials	Ratios
Electrophysiology of Vision	2
Advanced Para clinical Techniques in Optometry	3
Advanced Pediatric Optometry	2
Rehabilitation in Optometry	2
Advanced Ocular Diseases	2
Advanced Contact Lenses	1
Nonsurgical Treatment of Strabismus	1
Dispensing ophthalmic and telescopic spectacles	15
<b>Total</b>	<b>15</b>

In order to obtain information about the latest changes in the academic qualifications accepted for the entrance exam of each academic year, please refer to the medical science field's PhD exam booklet for that academic year.

## **The history and evolution of the course in the world and in Iran**

Modern optometry originates from the 15<sup>th</sup> century when Kepler, besides paying attention to mastering the science of Optics, also considered the mechanism of vision and image formation in the retina. However, the formation of this field as an academic field happened in 1902, in the USA. With the expansion of the boundaries of optometric knowledge and science, it was also introduced to European countries, Oceania, Asia, and Africa. Currently, Optometry is being taught seriously in more than 35 countries of the world. This field started in Iran in 1970s, and currently, there are about 2000 individuals serving in the society in the Bachelor's and Master's grades. The master's degree of this field was established about 10 years ago. With the launch of this field, a suitable context will be provided for deepening the issues related to the education, research and services of this field.

## **Career status of graduates**

Graduates of Ph.D. in optometry can be employed in the following positions:

- Educational groups of optometry and ophthalmology,

- Research centers of ophthalmology, visual sciences, cognitive sciences, biotechnology, medical engineering, optics, biophysics, optics physiology research centers
- Healthcare centers (government, charity, private) that have optometry and ophthalmology units.
- Optics industries, centers for making optometry equipment and glasses
- National Standard Research Organization
- Knowledge-based centers

## **Expected Competencies and Skills**

### **A- General Expected Competencies**

The general expected competencies for graduates of this grade are:

- Communication skills
- Education and teaching
- Researching and writing scientific articles
- Critical thinking and problem-solving skills
- Interpretation of tests and interventions performed according to the items included in the program
- Working in professional environments
- Evidence-based management skills, including policy, planning, program implementation, monitoring, supervision and quality control, and program evaluation.
- Skills to work with animals
- Physical and mental health of the work environment
- Use and maintenance of equipment
- Common measurements and instrument calibration
- Professionalism
- Lifelong self-improvement
- Providing counselling

**B- Specific skills:**

Skill	The minimum number of times a skill is performed to learn			
	observation	help in doing	Do independently	Total times
Refraction	5	5	10	20
Diplopia and orthoptic measurement tests	5	5	10	20
Analysis of psychophysical measurements	5	5	10	20
Contact lens fitting	10	10	10	30
Dispensing and fitting of various spectacles	10	10	10	30
Intraocular lenses power calculation	5	5	5	15
Advanced research methodology*	–	–	–	–
Investigating, recording and analysis of Visual Evoked Potentials (VEP)	5	5	5	15
Investigating, recording and analysis of Electroretinography (ERG) potentials	5	5	5	15
Investigating, recording and analyzing of Electrooculography (EOG) potentials	5	5	5	15
Impedance imaging in the visual system	5	5	5	15
Biomechanical evaluation of the visual system	10	10	10	30

perimetry	10	10	10	30
Fundoscopy	5	5	5	15
Fluorescein and indocyanine green angiography	10	–	–	10
Optical coherence tomography (OCT) and ...	10	10	10	30
Biomicroscopy of the anterior segment of the eye (use of Slit lamp)	5	5	5	15
Ultrasound A scan	10	10	10	30
Ultrasound B scan	10	–	–	10
Evaluation of the tear film	5	5	5	15
Tonometry (this skill has no diagnostic or therapeutic use.) <b>(without medication and treatment)</b>	10	10	–	30
Perform corneal imaging	10	10	10	30
Other paraclinical evaluations	10	10	10	30
Visual rehabilitation of children, teenagers, adults and the elderly	10	10	10	10

- Proficiency in the above cases is determined by the professor.

### **Educational Strategies:**

This program is based on the following strategies:

- Task based learning
- Problem-based learning
- Subject-directed learning
- Evidence-based learning
- A combination of student and professor
- Community-oriented learning
- Hospital-based learning

### **Educational methods and techniques:**

In this course, mainly the following teaching methods and techniques will be used:

- All kinds of intra-departmental, inter-departmental, hospital-based, interdisciplinary and inter-university conferences and seminars
- Discussion in small groups – educational workshops – journal club and book reading – case presentation
- Using distance learning techniques according to facilities and simulation
- Participation in the education of lower ranks
- Self-study
- Other educational methods and techniques based on the educational needs and goals

**Comprehensive assessment:**

Students will be assessed by the following modules:

- Written
- Oral
- Interactive computer test
- DOPS
- 360-degree test

**Portfolio assessment includes:**

Log book, Results of the tests performed, Articles, Encouragements and reminders, Work certificates and so on....

**b) Assessment frequency:**

- Continuous
- Periodical
- Final

## Chapter 3

### Course specifications and courses Optometry Curriculum for the Ph.D.

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**Name of the course: PhD in Optometry**

**Length of the program and form of the educational system:**

According to the educational regulations, the Ph.D. program is approved by the Supreme Planning Council of Medical Sciences.

**Total number of program credits:**

The number of study credits in this program is 50, which are as follows:

<b>Specialized Compulsory (Core) Credits</b>	25 credits
<b>Specialized Non-Core Credits</b>	5 credits
<b>Dissertation Credit</b>	20 credits
<b>Total</b>	50 credits

In addition to the course credits, the student is required to complete all or some of the deficiency or compensatory courses (Table A) with the approval of the educational department and the approval of the University's Graduate Education Council.

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**Table A- Deficiency or compensatory courses of the educational program of the Ph.D. in the field of Optometry**

Course Code	Name of the Course	Number of Credits			Number of Credit Hours			Prerequisite or Concurrent
		Total	theoretical	practical	Theoretical	practical	Total	
01	Medical information systems*	1	0/5	0/5	9	17	26	-
02	Electrophysiology of vision	2	-	-	34		34	
03	Ocular diseases (2)**	2			34		34	
Total		5	0/5	0/5				

\* The student is required to pass all or some of the deficiency or compensatory courses (Table A) with the advice of the educational department and the approval of the University Graduate Education Council.

\* Passing this course is mandatory for all students who have not passed it before as a deficiency or compensatory course.

\*\* The students of this course have completed eye diseases (1) course in the Master's course.

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**Table B: Compulsory Specializes (Core) Courses of the Ph.D. educational program in the field of Optometry**

Course Code	Name of the Course	Number of Credits			Number of Credit Hours			Prerequisite or Concurrent
		Total	theoretical	Practical	theoretical	practical	Total	
04	Advanced research methodology in optometry	2	2	—	34		34	
05	Basics and applications of psychophysical methods	3	2	1	34	34	68	
06	Advanced visual and ocular functional imaging methods	3	2	1	34	34	68	
07	Advanced vision therapy	2	1	1	17	34	51	
08	Seminar in Optometry and Vision Sciences	2	—	2	—	68	68	
09	Advanced rehabilitation of low vision	3	2	1	34	34	68	
10	Epidemiology of vision disorders and eye diseases	2	2	—	34	—	34	
11	Anterior segment of the eye and contact lenses	3	2	1	34	34	68	
12	Application of advanced techniques in correcting refractive errors of the eye	2	2	—	34	—	34	
13	Professional ethics	1	1	—	17	—	17	

14	Eye diseases affecting refractive errors	2	2	—	34	—	34	
Total		25	18	7				

Dissertation: 20 credits

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Table C: Optional special courses (Non-Core) of the educational program of the Ph.D. in the field of optometry

Credit Code	Name of the Credit	Number of Credits			Number of Credit Hours			Prerequisite or Concurrent
		Collective	Theoretical	Practical	theoretical	practical	Collective	
15	Statistical software	2	1	1	17	34	51	
16	Principles and methods of biomechanics and bioelectricity of vision	2	2	—	34	—	34	
17	Animal eyes	2	1	1	17	34	51	
18	New publications in binocular vision	1	1	—	17	—	17	
19	Color vision and visual sensitivity	1	1	—	17	—	17	
20	Molecular cellular basis of vision	2	2	—	34	—	34	
21	Neuroscience in vision	2	2	—	34		34	
Total		12	10	2				

\*Students must complete 5 credits of the above courses (Table C) according to the subject of the desired dissertation, with the approval of the supervisor, and the approval of the Graduate Education Council of the University.

**\*\*Educational workshops:**

Training to assess the lifestyle of people with vision disorders and low vision

Educational methods and techniques

Workshop on writing scientific articles

Biosafety workshop

\*\* It is suggested that these workshops be designed and implemented by the relevant educational group in the afternoon, or during the presentation of theoretical courses.

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**Course Name: Medical Information Systems**

**Course Code: 01**

**Prerequisite or Concurrent: None**

**Number of Credits: 1 (0.5 theoretical credit, 0.5 practical credit)**

**Course type: theoretical-practical**

**General Aims of the Course:**

At the end of this course, the student should be able to identify the different components of a personal computer and know the function of each one, be familiar with the Windows Operating System, be able to install and troubleshoot it, and learn to work with important applications. Moreover, the student should have the ability to use library templates and different search methods in important databases in their field of study and get familiar with the library services of the university where they study. Other goals of this course involve familiarization with popular internet browsers so that students can work with search engines and learn about famous and useful information sites in their field. At the end, the student must have the ability to create and use e-mail to send and receive letters and files.

**Course description:** In this course, the student will get to know the various components of a personal computer, the Windows Operating System, the Internet, important sites, e-mail, and databases, so that he can practically use the computer and its facilities for studying and researching in his field.

## **Outline (9 theoretical hours - 17 practical hours)**

\*Familiarity with personal computer:

- 1- Identifying various hardware components of personal computer and accessories
- 2- The function and importance of each hardware component and accessories

\* Familiarity and setting up the Windows Operating System:

- 1- Getting to know the history of advanced operating systems, especially Windows
- 2- Functionality and features of the Windows Operating System
- 3- How to use Windows Help
- 4- Familiarity with important Windows applications

\* Familiarity with important databases and practical-applicable software of the field of study

- 1- Introduction and information terminology
- 2- Familiarity with the reference books software of the field of study on CD and how to use them.
- 3- Familiarity with databases such as Medline, Embase, Biological Abstract, etc. and how to search in them.
- 4- Familiarity with Full-Text electronic magazines available on CD and searching methods in them.

**\* Familiarity with the Internet:**

- 1- Familiarity with information networks
- 2- Familiarity with important internet browsers and learning their various aspects
- 3- Learning how to set up the Internet browser to connect to the network
- 4- Learning how to work and search with important search engines
- 5- Familiarity with some famous and important sites of the field of study

## References

1-Finding Information in Science, Technology and Medicine Jill Lambert, Taylor & Francis, latest edition

2-Information Technology Solutions for Healthcare Krzysztof Zielinski et al., latest edition

## Student assessment:

**-In cognitive domain:** The students' assessment is done descriptively in the middle and at the end of the course.

**-In psychological-motor domain:** The practical assessment of the students' skill in using the personal computer, Windows Operating System, and Internet searches is done through a checklist.

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**Course Name: Electrophysiology of vision**

**Course**

**Code: 02**

**Prerequisite or Concurrent: -**

**Number of Credits: 2**

**Course Type: Theoretical**

**General Aims of the Course:**

Investigating, studying, and introducing the neurophysiology of the visual pathway and becoming fully familiar with the stages of sending neuronal information from the retina level to the cerebral cortex.

**Course description (34 theoretical hours):**

The main goal of this course is a basic and general review of the neurophysiology of vision, study and understand the process, analyze the findings, and their relationship with various ocular tissues, especially the retina, up to the level of the cerebral cortex.

**Outline:**

- Information and general review of the optic nerve and the cellular and functional structure of the optic nerves.
- Review of the general physiology of the optic nerves and the visual pathway from the optic nerve to the visual cortex
- Study of the state of the optic nerves at the retinal levels from the cellular perspective of the optic nerve
- LGN and the visual cortex
- Specific organization of nerve cells at each level of the eye-to-cortex nerve pathway
- Advanced review of receptive fields
- Causes of cellular disorders, especially amblyopia, in relation to receptive fields
- The flexibility and growth and expansion of optic nerve cells
- Clinical methods for examining the visual pathway and related parts
- Diagnosis of visual pathway disorders using clinical tools
- Relationship between visual acuity and neural pathways, especially the contrast sensitivity system
- Neural examination of ocular movements and complete adaptation and the relationship of these two factors with neural pathways
- Recording visual thresholds and visual field
- Performing psychophysical and clinical tests of the visual field
- Investigating various visual field strategies and their relationship with brain activity and cortical cells

**References:**

1. Kaufman PL, Alm A, Leonard AL, Nilsson SFE, Hovee JV, Wu S. Adler's. Physiology of the Eye, 11th Edition. Mosby, 2011.
2. Davson H. Davson physiology of the eye, Elsevier, Latest edition

**Student assessment:**

Class Activities: 20% of total

Midterm Exam: 30% of total

Final Written Exam: 50% of total

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**Course Name: Ocular diseases (2)****Course Code: 03****Prerequisite or Concurrent: none****Number of Credits: 2****Course Type: Theoretical****General Aims of the Course:**

Familiarity with basic science and pathology to understand the pathophysiological mechanisms of eye diseases, in order to refer such patients to an ophthalmologist for prevention and treatment.

**Course Description:** In some developed countries (America...), one of the optometrists' duties is to diagnose, treat, and research eye diseases. Some systemic diseases affect refractive errors and vision whose diagnosis, research, and referral to relevant specialists seem essential.

**Outline (34 theoretical):**

- Basic sciences related to the pathophysiology of eye diseases: cell biology, biochemistry, microbiology and immunology
- Basic pathology related to the pathophysiology of eye diseases: inflammation, infection, immune disease, neurological disease, ocular disease and various anomalies.
- Special diseases affecting vision: diabetes and its ocular complications, presbyopia and cataract, anterior segment eye disease, glaucoma, dry eye, refractive surgery, vitreous and retinal disease and macula.

**References:**

Roberts DK and Terry, JE. Ocular disease. Diagnosis and treatment. Butterworth-Heinemann, Boston, Latest edition.

**Student assessment:**

Class Activities: 20% of total

Midterm Exam: 30% of total

Final Written Exam: 50% of total

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**Course Name: Advanced research methodology in optometry**

**Course**

**Code: 04**

**Prerequisite or concurrent: None**

**Number of Credits :2**

**Course Type: theoretical**

**General Aims of the Course:**

Familiarizing students with designing a research plan, preparing a proposal, and planning for its implementation so that they can prepare a research proposal at the end of the course.

**Course Description:** In this course, the student will be familiar with the method of justifying a research plan and writing it and documenting the relevant literature. He will be able to complete the components of a research proposal simultaneously with the study design and finally prepare the arrangements for implementing the plan. Along this way, he will also be familiar with the method of presenting and obtaining approval for a research plan.

**Outline (34 theoretical hours):**

-Become familiar with reviewing the literature on a topic and preparing its results in the form of a documented text based on the observed references.

-Become familiar with the components of a proposal and how to write it, including: an introduction to the types of literature review, writing title and preparing introduction,

formulation of objectives, design of the study format, design of the implementation method, sample size estimation, ethical issues, design - implementation plan and Gantt, budgeting and estimating the required human resources

-Become familiar with the variations in different proposals according to the field and type of study, such as the difference between designing qualitative and quantitative studies.

-Become familiar with research management methods in implementing a research project

**References:**

1- Health Systems Research WHO World Health Organization Latest Edition

2. Hulley SB, Cummings SR, Browner WS, et al. Designing clinical research: an epidemiologic approach, latest edition.

**Student assessment:**

Final written exam: 50% of total

Proposal presentation: 50% of total

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**Course Name: Basics and applications of psychophysical methods      Course Code: 05**

**Prerequisite or concurrent: None**

**Number of Credits :3**

**Course Type: 2 theoretical credits - 1 practical credit**

**General Aims of the Course:**

1- Improving the level of knowledge and ability of students in recognizing the basics and principles of visual psychophysics sciences

2- How cognition is formed

3- Cognitive systems of the human brain

4- Issues related to growth and development (Cognition)

- 5- Mechanism and structure of learning in the human brain
- 6- Neuroplasticity
- 7- Neurotransmitters and the phenomenon of learning
- 8- Memory and its types and how short-term and long-term memory work
- 9- Psychophysical tests
- 10- Design and implementation of these tests
- 11- Methods of analyzing these tests

**Course description:**

\*Better understanding of the process of cognitive evolution based on visual psychophysics, neuroplasticity and its importance in cognition and familiarity with neurotransmitters and its importance in learning and the mechanism of learning structure in the human brain

-Interaction of cognitive systems and the visual system at different levels based on psychophysical methods

**Outline: (34 theoretical hours)**

**Cognition and its evolution**

- 1 - Discussions about the evolutionary process of human brain formation
- 2 - Cognitive systems of the human brain
- 3 - Discussions related to growth and development (Cognition)
- 4 - Mechanism and structure of learning in the human brain
- 5 - Neuroplasticity
- 6 - Neurotransmitters and the phenomenon of learning
- 7 - Memory and its types and how short-term and long-term memory work
- 8 - Emotional theories, bias (emotional laterality)
- 9 - Psychophysical mechanisms
- 10- Basic neuropsychological rehabilitation

11-The connection between the brain and human behavior, such as motivation, sex, emotion, language, attention, learning and memory.

**Outline: (34 practical hours)**

1-Familiarity with psychophysical laboratory tools

2-Performing visual threshold determination methods

3-Performing ascending and descending, exponential and linear methods for psychophysical tests

4-Designing and performing open loop visual psychophysical tests

5-Designing and performing closed loop visual psychophysical tests

6-Performing (modulative) visual tests

7-Performing (inductive) visual tests

8-Performing adaptive methods in visual psychophysics

**References**

1. Applications of Parallel Processing in Vision (*Advances in Psychology*) by J.R. Brannan latest edition

2. Visual Perception: A Clinical Orientation, Fourth Edition by Steven H. Schwartz, 2009

3. The cognitive Neuroscience of action "Marc Jeannerod 1997, Black well Publishers Ltd.

4. Developmental cognitive Neuroscience Mark H. Johnson 1997 - Black well Publishers

5. Psychology of Vision (*Royal Society Discussion Volumes*) by Royal Society (latest edition)

6. Synaptic Plasticity - Michel Baudry Xiaoniny Bi Steven S. Schreiber 2005, Taylor & Francis Group, LLC

7. Cognitive neurorehabilitation - Donald T Stuss, Gordon Winocur, Ian H. Robertson. latest edition, Cambridge University

8. What is cognitive science - Ernest Lepore and Zenon Tylyshyn, Blackwell Publishers Ltd, 1999

9. The cognitive neuroscience of consciousness - Stanislas Dehaene. 2001 Elsevier Science Publishers

10. Perception and Illusion: Historical Perspectives (Library of the History of Psychological Theories) by Nicholas J. Wade (2004) the latest print of all above books

**Student assessment:**

Midterm written exam: 40%

Class conference: 20%

Final exam: 40%

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**Course Name: Advanced visual and ocular functional imaging methods      Course Code: 06**

**Prerequisite or Concurrent: ---**

**Number of Credits: 3**

**Course type: 2 theoretical credits – 1 practical credit**

**General Aims of the Course:**

Improving the level of knowledge and ability of students in:

- 1 - Understanding the basic principles of imaging using different physical agents such as magnetic fields, electric currents, ionizing and non-ionizing radiation
- 2 - Principles and processes of image information processing
- 3 - Familiarity with imaging methods in different parts of the eye and visual system
- 4 - Familiarity with fMRI methods
- 5 - Familiarity with imaging methods of the cornea, lens, retina and optic nerves
- 6 - Radiographic methods in the eye
- 7 - Basics of CT scan in the eye and visual system
- 8 - Impedance imaging methods in the eye and visual system

**Course Description:**

By learning the content of this course, the student will understand the role of imaging methods of the visual system and the importance and application of each in research and clinical cases.

**Outline: (34 theoretical hours)**

- 1 - Basic principles of imaging
- 2 - Principles of imaging using magnetic fields and introduction to fMRI methods
- 3 - Principles of imaging using electrical currents and impedance imaging in the eye and visual system
- 4 - Principles of imaging using ionizing radiation and radiographic methods in the eye and basics of CT scan in the eye and visual system
- 5 - Principles of imaging using non-ionizing radiation
- 6 - Principles of imaging using laser beams
- 7 - Principles and process of image information processing
- 8 - Combined imaging methods in different parts of the eye and visual system
- 9 - Introduction to imaging methods of the cornea, lens, retina and optic nerves

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**Outline: (34 practical hours)**

- 1- Performing non-ionizing radiation dosimetry methods
- 2- Performing magnetic field dosimetry methods
- 3- Programming in imaging systems
- 4- Practical analysis of digital images
- 5- Working with an MRI machine
- 6- MRI machine analysis
- 7- Quantitative and qualitative analysis and reading of IMRI images

8-Performing methods to determine the repeatability, accuracy, and predictive value of IMRI

**References:**

1- Medical Retina: Focus on Retinal Imaging (Essentials in Ophthalmology) by Frank Holz and Richard F. Spaide (2010)

2- Imaging the Eye from Front to Back with RTVue Fourier-Domain Optical Coherence Tomography by David Huang MD PhD, Jay S. Duker, James G. Fujimoto PhD, and Bruno Lumbroso (2010)

3- Practical Imaging Informatics: Foundations and Applications for PACS Professionals by Barton F. Branstetter IV (2009)

4- Automated Image Detection of Retinal Pathology by Herbert Jelinek and Michael J. Cree (2009)

5- Dynamic Ophthalmic Ultrasonography: A Video Atlas for Ophthalmologists and Imaging Technicians by Julian Pancho S. Garcia Jr., Paul T. Finger, and Richard B. Rosen (2009)

6- Retinal Imaging Simplified by Darrin A Landry, Patricia Evans, and MD Adam h Rogers (2009)

7- Atlas of Neuro-ophthalmology by Thomas C. Spoor (2004)

8- Emergence of Visual Content in the Human Brain: Investigations of Amblyopia, Blindsight and High-level Motion Perception with FMRI (Berichte Aus Der Medizin) by Lars Muckli (2002)

9- Principles and Practice of Clinical Electrophysiology of Vision, 2nd Edition by John R. Heckenlively and Geoffrey B. Arden (2006)

10-Electrophysiology of Vision: Clinical Testing and Applications by Byron L. Lam (2005)

**Student assessment:**

Midterm Exam: 20%

Project: 30%

Final exam: 50%

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**Course Name: Advanced Vision Therapy**  
**Code: 07**

**Course**

**Prerequisite or concurrent: None**

**Number of credits: 2**

**Course type: 1 theoretical credit - 1 practical credit**

**General Aims of the Course:**

- 1 - Review of monocular and binocular vision conditions
- 2 - Review of binocular spatial perception
- 3 - Growth and development in cyclofusion
- 4 - Introduction to static and dynamic stereoacuity
- 5 - Basics of orthoptics in monocular and binocular disorders
- 6 - Static and dynamic techniques of vision training
- 7 - Stages of vision training based on psychophysical and neurological models
- 8 - Vision practices in people over 40 years old

**Course Description:**

Understanding the different areas of vision and orthoptic training, such as:

- Growth and development and the role of near reflexes
- Regulatory function of binocular vision
- Mechanisms of activation of visual reflexes in the cerebral cortex
- Structure and interaction of reflexes at different psychophysical and neurological levels
- Mechanisms of age-based vision training

**Outline (17 theoretical hours)**

- 1 - Fundamentals of temporal-spatial visual perceptions
- 2 - Temporal-spatial characteristics of binocular vision in healthy individuals and binocular vision disorders

- 3 - Psychophysical models of binocular vision
- 4- Stereoacuity models in static and dynamic conditions
- 5 - Color and non-color stereopsis
- 6 - Fundamentals of visual skills
- 7 - Methods of assessing and developing visual skills
- 8 - Methods of integrating visual reflexes

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**Outline (34 practical hours)**

- 1-Recall and review of the principles of vision exercises
- 2-Review of orthoptics equipment such as synoptophore
- 3-Perform monocular and binocular training
- 4-Perform binocular spatial perception training
- 5-Perform cyclofusion training
- 6-Perform static and dynamic stereopsis training
- 7-Perform static and dynamic vision training
- 8-Perform psychophysical and cognitive training
- 9-Perform specific exercises for people over 40 years of age

**References:**

- 1- Eyegames: Easy and Fun Visual Exercises: An OT and Optometrist Offer Activities to Enhance Vision! by Lois Hickman MS OTR FAOTA and Rebecca Hutchins OD FCOVD (2010)
- 2- The Vision Revolution: How the Latest Research Overturns Everything We Thought We Knew About Human Vision by Mark Changizi (2010).
- 3- The Art of Cosmic Vision: Practices for Improving Your Eyesight by Mantak Chia and Robert T. Lewanski (2010)

4- Pediatric Ophthalmology, Neuro-Ophthalmology, Genetics: Strabismus New Concepts in Pathophysiology, Diagnosis, and Treatment (Essentials in Ophthalmology) by Birgit Lorenz and Michael C. Brodsky (2010)

5- 45 Lazy Eye Exercises: Eye Patch Exercises To Improve Vision for Those Who Suffer From Amblyopia by Tammie Taylor (2009)

6- Eye Infections, Blindness and Myopia (Eye and Vision Research Developments) by Jeffrey Higgins and Dominique Truax (2009)

7- Optometry: Science, Techniques and Clinical Management by Mark Rosenfield MCOptom PhD FAAO and Nicola Logan MCOptom PhD (2009)

8- Eye Power: An Updated Report on Vision Therapy by Ann M. Hoopes and Stanley A. Appelbaum (2009)

9- Clinical Management of Binocular Vision: Heterophoric, Accommodative, and Eye Movement Disorders by Mitchell Scheiman and Bruce Wick (2008)

10- Advances in Understanding Mechanisms and Treatment of Infantile Forms of Nystagmus by R. John Leigh and Michael W. Devereaux (2008)

**Student assessment:**

Midterm Exam: 20%

Conference Presentation and Class Projects: 40%

Final Exam 40%

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**Course Name: Seminar in Optometry and Vision Sciences**

**Course**

**Code: 08**

**Prerequisite or Concurrent: None**

**Number of credits :2**

**Course Type: 2 Practical credits**

**General Aims of the Course:**

Translation, writing or researching and presenting specialized materials in one of the specialized fields of optometry, including:

- 1) Diagnosis of vision disorders
- 2) Vision rehabilitation
- 3) Optometry consultation and management

**Course Description:** Based on what has been learned in this course, the student must translate, write, or research and present topics using available specialized resources.

**Outline (68 practical hours)**

-Selecting the title of “seminar” for the learner is based on the priorities of translation, writing, and research with the guidance of the Ph.D. Optometry supervisor.

**References:**

- All specialized books in the field of optometry from 2002 onwards
- Articles available in Medline and the Internet and all databases

**Student assessment:**

- Oral presentation of materials in meetings throughout the semester: 50%
- Written presentation: 20%
- Collection of materials and final report: 30%

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**Course Name: Advanced rehabilitation of low vision**

**Course Code: 09**

**Prerequisite or Concurrent: ---**

**Number of credits: 3**

**Course type: 2 theoretical credits - 1 practical credit**

**General Aims of the Course:**

- Familiarity with basic and advanced concepts of low vision treatment methods
- Methods of examining, recording and analyzing visual acuity using objective and subjective methods and assessing visual potential.
- Familiarity with eye diseases and the visual system that leads to low vision
- Vision standards based on social, occupational, functional indicators and visual needs
- Optical basics of visual aid equipment
- Electronic basics of visual aid equipment
- Familiarity with non-optical, non-electronic visual aid equipment
- Familiarity with sensory-motor coordination methods in people with low vision
- Sensory-cognitive psychology of people with low vision
- Dynamic training - coordination of people with low vision

**Course Description:**

Learners should be able to properly assess the structural, sensory, and motor conditions of visually impaired individuals. Ability to prescribe visual aid equipment and to design, manufacture, and assemble visual aid facilities for visually impaired patients. Educating patients on the optimal use of visual aid facilities as well as sensory-dynamic training and exercises for visually impaired patients.

**Outline: (34 theoretical hours)**

- Recording history and clinical observations
- Recording patient medical history
- Special examinations for specific patients, behavioral observations, psychological and social information
- Recording objective involuntary visual responses
- Evaluating sensitivity of the counter and glare
- Basics of physical-motor rehabilitation
- Nonlinear optics and dynamic magnification
- Electronic eyepieces and electronic visual aid equipment
- Visual and non-visual aid equipment

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**Outline: (34 practical hours)**

1- Attending an optometry clinic and performing vision examinations, analyzing and prescribing vision aids.

2- Going to the houses, workplaces, traffic, and other places where visually impaired patients are located.

2-1- Detailed and comprehensive analysis of patients and providing problem-oriented recommendations.

**References:**

1-Foundations of Low Vision: Clinical and Functional Perspectives, Anne Lesley Corn, Jane N. Erin 2010 965 pages.

2-Low Vision Assessment, Jane MacNaughton, Jane Macnaughton (MCOptom.) 2005-237 pages  
3-Low Vision Manual, A. Jonathan Jackson. James S. Wolffsohn, Ian L. Bailey 2007-381 pages

4-On the Special Needs of Blind and Low Vision Seniors, Hans-Werner Wahl, Hans-Eugen Schulze 2001-351 pages.

5-Living with Low Vision And Blindness: Guidelines That Help Professionals, John M. Crandell, Lee W. Robinson 2007-205 pages.

**Student Assessment:**

Midterm Exam (Multiple Choice, Essay, Comparative): 40%

Conference and Class Projects: 20%

Final Exam: 40%

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**Course Name: Epidemiology of vision disorders and eye diseases**

**Course Code: 10**

**Prerequisite or Concurrent: None**

**Number of credits: 2**

**Course Type: Two theoretical credits**

**General Aims of the Course:**

At the end of the course, the student is expected to be familiar with the principles and methods of epidemiology, and have acquired the ability to calculate health and disease measures. Also, know the types of epidemiological studies and the characteristics and applications of each well. To have acquired basic skills in critically interpreting epidemiological texts related to community health. Also, to be familiar with the epidemiology of major eye problems in the world and Iran.

**Course Description:**

In this course, students will become familiar with the principles of epidemiology, including topics related to errors (types of random and systematic errors), causality, types of epidemiological studies, health and disease measurement indicators, methods of critiquing reports and articles, and also be familiar with the epidemiology of major eye diseases in Iran and the world.

**Outline (34 theoretical hours):**

- Epidemiological concepts and models (scope of epidemiology - disease severity - disease models)
- Health and disease measures (risk, chance, and rate)
- Effect estimation measures (relative and absolute risk)
- Principles of study design
- Cross-sectional and ecological studies, power and limitations
- Cohort studies, power and limitations

- Case-control studies, power and limitations
- Interventional studies, power and limitations
- Difference between Statistical relation and causality of random error, bias and confounding in epidemiological studies
- Concepts of sensitivity, specificity and predictive value of screening
- Epidemiology of major eye diseases in Iran and the world including: refractive errors, keratoconus, cataract, glaucoma, major retinal diseases, low vision and vision problems in children
- Main risk factors of major eye diseases

**References:**

1. Gordis L. Epidemiology. W.B. Saunders Company, latest edition.
- 2-Malek Afzali H, Majdzadeh R, Fotohi A et al. Methodology of Applied Research in Medical Sciences. Tehran: Latest Edition

**Student assessment:**

Class Activities ... 20% of total score

Final Exam ..... 80% of total score

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**Course name: Anterior segment of the eye and contact lenses**

**Course**

**Code: 11**

**Prerequisite or Concurrent: None**

**Number of the credits: 3**

**Course type: 2 theoretical credits - 1 practical credit**

**General Aims of the Course:**

To familiarize students with the evaluation of the anterior segment of the eye in contact lens prescription and research.

**Course Description:** Due to the use of contact lenses by a large number of patients instead of glasses, it seems necessary to understand the complications of contact lenses in the anterior segment.

In this course, the student will be introduced to the important factors of the anterior segment of the eye, including the cornea, tear film, and conjunctiva, in the prescription and research of contact lenses. The diagnosis and treatment of anterior segment diseases of the eye due to the use of contact lenses will be evaluated in this course.

**Theoretical Outline (34 theoretical hours)**

- Biology and physiology of the cornea, conjunctiva and tear film and evaluation of studies conducted
- Biomicroscopy of the anterior segment of the eye and its evaluation in the prescription and research of contact lenses
- Ultrasound and its evaluation in the prescription and research of contact lenses
- Evaluation of the tear film on the cornea in relation to the prescription and research of contact lenses
- Gonioscopy and its evaluation in the prescription and research of contact lenses
- Tonometry and its evaluation in the prescription and research of contact lenses
- Evaluation of the lacrimal system in relation to the prescription and research of contact lenses
- Evaluation of corneal topography in relation to the prescription and research of contact lenses
- Evaluation of corneal surgeries in relation to the prescription and research of contact lenses
- Evaluation of new contact lenses in relation to the ocular complications caused by them
- Evaluation and treatment of some diseases caused by the use of contact lenses
- Use of PROSE contact lenses in the treatment of superficial eye diseases
- Prescription of hybrid lenses in anterior segment diseases
- Indications and contraindications of Clearcon lenses in eye diseases

-Crosslinking techniques in eye diseases

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**Practical Outline (34 practical hours):**

In this course, students will be introduced to the application of new techniques in the evaluation and research of various parts of the anterior segment of the eye in relation to contact lenses and the treatment of diseases caused by contact lens use.

**References:**

1-Benjamin WJ, Borish clinical refraction, Butterworth. Heinmann Elsevier, latest edition.

2-Grosvenor, T, Primary care optometry, Butterworth – Heinmann Elsevier, latest edition.

3-Bennett ES, Henry VA. Clinical management of contact lenses 3<sup>rd</sup> ed, Lippincott William and Wilkins, 2009.

**Student assessment:**

**A – Theoretical:**

Class activities: 20% of the total score

Midterm exam: 30% of the total score

Final written exam: 50% of the total score

**B – Practical:**

This will be done at the discretion of the relevant professor.

**Course Name: Application of advanced techniques in correcting refractive errors of the eye**

**Course Code: 12**

**Prerequisite or Concurrent: None**

**Number of the credits: 2**

## **Course Type: Theoretical**

### **General Aims of the Course:**

To familiarize the student with new methods of optical correction of refractive errors

### **Course Description:**

Due to the changing lifestyle and prolonged use of the eyes, especially at close range, including reading, working with a computer, etc., and the increasing incidence of refractive errors, especially myopia, in today's human society, there are various methods for correcting and treating refractive errors. In this course, new and advanced methods for correcting refractive errors of the eye after refractive surgery and using artificial devices, and studies conducted in this field, are examined and evaluated.

### **Outline (34 theoretical hours):**

-Radial keratotomy (RK:) history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-Laser refractive excimer keratectomy (PRK): history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-LASIK (LASIK): history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-Intrastromal corneal ring (ICR): history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-IOL implantation in phakic eyes: history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-Hyperopia and astigmatism surgery: history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-Presbyopia surgery: history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-Corneal Transplantation: history, method, consequences, conducted studies, evaluation, optical correction of residual refractive errors

-Optometric collaboration with types of refractive error surgery

**References:**

- 1.Grosvenor T. Primary care optometry, Butherworth-Heinemann, ELsever, latest edition.
- 2.Benjamin WJ, Borish clinical refraction, Butterworth-Heinemann, Elsevier, latest edition.

**Student assessment:**

Class activities: 20% of total score

Midterm exam: 30% of total score

Final written exam: 50% of total score

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**Course Name: Professional ethics**

**Course Code: 13**

**Prerequisite or Concurrent: None**

**Number of the credits: 1**

**Course type: 1 theoretical credit**

**General Aims of the Course:**

To familiarize students with the principles, foundations, rules, and practical solutions for applying ethical issues in scientific research in the field of optometry.

**Course Description:**

In this credit, students will first be introduced to the theoretical concepts of ethics and then briefly learn some philosophical foundations of ethics that are involved in research decision-making in medical sciences. Then, legal issues such as the dimensions of

intellectual property, confidentiality, and informed consent, and common laws and ethical codes in regulations will be discussed.

**Outline: (17 theoretical hours)**

- Definition of ethics, professional and medical ethics
- Ethical philosophies, history of medical ethics
- Islamic perspective on the philosophy of ethics, the relationship between religion and ethics, the spiritual value of the eye and gaze
- Main elements and ethical principles in research
- Intellectual property, rights of the researcher and supporting organizations
- Rights of participants in research, informed consent and how to write it
- Confidentiality and rights of the patient and his/her parents, special patients (mentally disabled, children, prisoners)
- Ethical codes in the regulations of ethics committees
- Ethics in publishing research results
- benefits and harms in medical research
- Shariah rulings and the degree of necessity in medical research

**References:**

- Smith, Terror. Ethics in Medical Research. Translated by Zargham. Mohammad. Introduction by Larijani. Baqir. Publisher. For Tomorrow. Ch. 1. 2002
- Hojjat, Hadi and Talati, Mohammad Hadi. The Rules of Physicians and Medical Professions. Publisher of the Islamic Propaganda Office. Qom, Ch. 1. 2007
- Khomeini, Ruhollah, Tahrir al-Wasilah, Ch. 2, Translation and Publication, Institute for the Compilation and Publication of Imam Khomeini's Works, 2007
  
- Farhadi, Yadollah et al. Ethical Standards in Medical Sciences Research. Publisher, National Center for Medical Sciences Research, 1st edition, 2003
- Gharamaleki, Faramarz. Professional Ethics, 1st edition, 2003. Tehran
- Motaheri, Morteza Education in Islam, 20th edition, Sadra Publications, 1992.

-Motaheri, Morteza, Philosophy of Ethics, 3rd edition, Sadra Publications, 1988

-Ministry of Health, Medical Education and Medical Ethics, 1st edition, 2008

**Student assessment:**

Class Activities: 20% of total score

Mid-term Exam: 30% of total score

Final Written Exam: 50% of total score

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**Course Name: Eye diseases affecting refractive errors**

**Course**

**Code: 14**

**Prerequisite or Concurrent: None**

**Number of the credits: 2**

**Course Type: Theoretical**

**General Aims of the Course:**

To familiarize the student with various eye diseases affecting refractive errors.

**Course Description:** Some eye diseases cause changes in refractive errors, but there are also diseases that do not affect the refractive errors of the eye and do not change the patient's visual acuity. Therefore, refractive errors of the eye are key to diagnosing some eye diseases and other diseases of the body, which optometrists must pay attention to and be sensitive to.

In this course, the refractive effect of eye diseases and studies conducted in this regard are examined, evaluated and researched.

**Outline (34 theoretical hours):**

-Eyelid diseases: Chalazion, eyelid tumors

-Corneal diseases: Keratoconus, Pellucid marginal degeneration, Terrien marginal degeneration

-Conjunctival diseases: Pterygium

- Lenticular diseases: Aging crystalline lens, Nuclear sclerosis, Cortical cataract, Lenticonus, Lens displacement
- Ciliary body: Melanoma
- Ectopy of the lens: Ectopia Lentis
- Marfan syndrome:
- Homocystinuria
- Marchesani Weil
- Danlos - Ehlers
- Aniridia
- Crouzon syndrome
- Hyperlysinemia
- Sulfite oxidase deficiency
- Severe myopia:
- Sticklers syndrome
- Supracilliary detachment
- Uveal detachment
- Different causes of retinal detachment (Exudative, Tractional or Rhegmatogenous)
- Different causes of macular edema or elevation of macula area
- Harada Koyanagi: Vogt syndrome
- Orbital diseases: Intra-orbital tumors
- Optic nerve neoplasia (Optic nerve tumors)
- Posterior scleritis
- Papilledema
- Systemic diseases
- Kidney failure and hemodialysis diseases
- Pathological myopia

- Retinal detachment surgery

**References:**

Heinemann, Elsevier, latest edition. -Benjamin WJ, Borish clinical refraction, Butterworth

**Student Assessment:**

Class Activities: 20% of total score

Midterm Exam: 30% of total score

Final Written Exam: 50% of total score

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**Course Name: Statistical software**

**Course**

**Code: 15**

**Prerequisite or Concurrent: None**

**Number of the credits: 2**

**Course Type: 1 theoretical credit - 1 practical credit**

**General Aims of the Course:**

Among the important objectives of this course is to familiarize the student with various common and applied computer software at an advanced level and to strengthen the ability and awareness of PhD students in the field of optometry. On the other hand, this course will try to strengthen the students' practical capabilities in the field of using these software and reach a desirable level.

**Course Description:**

In this course, details, features, applications, and how to work with various computer software including MS Excel, MS Access, MS Power Point, Endnote, Paint Shop Pro, Corel Draw, Sigma Plot, Chemwin, and other software related to Graph digitizing, Design Expert, and other software related to the topic of Optimization as well as software related to performing advanced statistical calculations will be presented.

**Outline (51 hours):**

## **A - Theoretical (17 hours)**

1 - Details of features, applications and how to work with MS Access software at an advanced level

2 - Details of features, applications and how to work with MS Power Point software at an advanced level

3 - Details of features, applications and how to work with Endnote software at an advanced level

4 - Details of features, applications and how to work with Paint Shop Pro software at an advanced level

5 - Details of features, applications and how to work with Corel Draw software at an advanced level

6 - Details of features, applications and how to work with Sigma Plot software at an advanced level

7 - Details of features, applications and how to work with Chemwin software at an advanced level

8 - Details of features, applications and how to work with Graph digitizing software at an advanced level

9 - Details of features, applications and how to work with Design Expert software and other software related to the topic Optimization

10 - Software related to performing statistical calculations and how to work with them at an advanced level

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## **B) Practical (34 hours)**

The student must be able to work practically with all the computer software mentioned in Part A (Theoretical) and be fully familiar with their use.

### **References:**

1 - Collection of educational books of the Science Publishing Center, related to various software. Abacus Publishing, Science Publishing Center.

2 - Other books and internet resources related to various software mentioned

3-Dawson, B, & Trapp, R.4., Basic & Clinical Biostatistics, 2001, Mc Graw-Hill Medical Publishing Division.

**Student assessment:**

Mid-term written exam: 40%

Final practical: 60%

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**Course Name: Principles and Methods of Biomechanics and Bioelectricity of vision    Course Code: 16**

**Prerequisite or Concurrent: None**

**Number of the credits: 2**

**Course type: Theoretical**

**General Aims of the Course:**

Improving the level of knowledge and ability in:

1 - Understanding the principles of biomechanics

2 - Understanding the principles of bioelectricity

3 - Understanding the theory of volumetric conductor and cable theory

4 - Understanding the sink and source of voltage

5 - Clinical methods for evaluating the biomechanical and bioelectric properties of the eye and the visual system

**Course Description:**

1 - Familiarity with the biomechanical and bioelectric properties of the cell

2 - Familiarity with the principles and biomechanical properties of the cornea

3 - Familiarity with the principles and biomechanical properties of glaucoma

4 - Familiarity with the principles and biomechanical properties of the anterior and posterior segments of the eye.

5 - Familiarity with the principles and bioelectric properties of excitable tissues of the eye

6 - Familiarity with the principles and bioelectric properties of the visual pathway and visual cortex

**Outline: (34 theoretical hours)**

**Review of:**

1-Biomechanical and bioelectric properties of the membrane and cytoplasm

2- properties of the membrane and intracellular organelles

3-Biomechanical and bioelectric properties of the cornea.

4- Biomechanical and bioelectric properties of glaucoma

5- Biomechanical and bioelectric properties of the anterior and posterior segments of the eye

6- Bioelectric properties of excitable tissues of the eye including nerves and various parts of the retina

7- Introduction to the principles and bioelectric properties of the visual pathway and visual cortex

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**References:**

1- Introductory Biomechanics: From Cells to Organisms (Cambridge Texts in Biomedical Engineering) by C. Ross Ethier and Craig A. Simmons (2007)

2- Mechanisms of the Glaucomas: Disease Processes and Therapeutic Modalities by Joyce Tombran-Tink, Colin J. Barnstable, and M. Bruce Shields (2008)

3- Mechanosensitivity of the Nervous System (Mechanosensitivity in Cells and Tissues) by Andre Kamkin, Irina Kiseleva, N. Tavernarakis, and P. Persson (2008)

4- Clinical Procedures for Ocular Examination by Daniel Kurtz and Nancy B. Carlson (2003)

5- Modeling & Imaging of Bioelectrical Activity: Principles and Applications) by Bin He, Bioelectric Engineering (2004)

6- Biomedical Engineering Fundamentals (The Biomedical Engineering Handbook, Third Edition) by Joseph D. Bronzino (2006)

7- Neural Engineering (Bioelectric Engineering) by Bin He (2005)

8- Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields by Jaakko Malmivuo and Robert Plonsey (1995)

9- Electrodes and the Measurement of Bioelectric Events by L. A. Geddes (1972)

10-Principles and Practice of Clinical Electrophysiology of Vision, 2nd Edition by John R. Heckenlively and Geoffrey B. Arden (2006)

11-Electrophysiology of Vision: Clinical Testing and Applications by Byron L. Lam (2005)

**Student assessment:**

Written Midterm Exam: 30%

Class Projects: 20%

Final Exam: 50%

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**Course name: Animal eyes**  
**17**

**Course Code:**

**Prerequisite or Concurrent: None**

**Number of the credits: 2**

**Course type: 1 theoretical credit - 1 practical credit**

**General Aims of the Course:**

To familiarize students with the evolutionary process, anatomical development, and surgery operations of vision in the vertebrates' eyes and compare it with the human eye.

**Course Description:**

In this course, the development stages of the visual system from conception to maturity-biological mechanisms controlling eye growth-the phenomenon of ametropia, the mechanisms of adaptation and binocular vision in different vertebrates are described and compared with the human eye.

**Outline of Theoretical Course (17 hours):**

History of the use of laboratory animals

Ethical principles of working with laboratory animals

Introduction to types of laboratory animals.

How to choose the right animal for study

Reliability of information obtained from laboratory animals and its compatibility with human samples

Understanding the needs of animals and how to keep them

Reproduction in laboratory animals

Methods of restraining and transporting laboratory animals

Methods of numbering animals

Types of anesthesia models and their use

Methods of blood collection and injection

Autopsy

Common surgeries

Easy death

Stages of development of the visual system from fertilization to puberty

Biological mechanisms controlling growth

Eye Mechanism of accommodation and binocular vision in the eye of vertebrates

The phenomenon of ametropia

Morphological changes of the cornea in different vertebrates

Morphological changes of the lens in different vertebrates

Morphological changes of the vitreous and retina in different vertebrates

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**Outline of Practical Course (34 hours):**

Practical courses will be taught according to the syllabus of theoretical courses.

**References:**

1-Ross L Cagen Thomas A. Reh Invertebrate and Vertebrate Eye Development, 1st ed.  
Academic Press; 2010, Volume 93.

2-M. Elizabeth Fini. Vertebrate Eye Development. 1st ed. Springer; 2000

**Student assessment:**

**A- Theoretical:** At the end of the semester, evaluation will be done by the professor(s) by holding a written exam. The questions will be descriptive or multiple-choice. In this course, the student will be required to present a seminar on one of the topics presented by the professor, and 30% of the total grade will be allocated to the seminar credit.

**B- Practical:** It will be done with the opinion of the relevant professor.

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**Course Name: New publications in binocular vision**

**Course Code: 18**

**Prerequisite or Concurrent: None**

**Number of the credits: 1**

**Course Type: Theoretical**

**General Aims of the Course:**

To get familiar with new publications in the field of binocular vision and its disorders

**Course Description:**

In this course, the students will get familiarized with the most recent researches in different fields of binocular vision disorders and they will be evaluated on the basis of carrying out research projects in this field.

**Theoretical outline (17 theoretical hours):**

- New publications in eye movements and their disorders
- New publications in heterophoria
- New publications in strabismus and its causes
- New publications in sensory disorders of binocular vision
- New publications in the epidemiology of binocular vision disorders
- New publications in accommodation and convergence disorders
- New publications in nystagmus and its causes
- New publications in Orthoptics

**References:**

1. Schor CM, Giuffreda KJ. Vergence eye movements: Basic and clinical aspects. Butterworths, Sydney, Latest edition..
2. Scheiman MS, Wick B, Steineman B. Clinical management of binocular vision: Heterophoria, accommodation and eye movement disorders, Lippincott William and Wilkins, Philadelphia, Latest edition.

**Student assessment:**

Class Activities: 20% of Total Grade

Midterm Exam: 30% of Total Grade

Final Written Exam: 50% of Total Grade

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**Course name: Color vision and visual sensitivity**

**Course Code: 19**

**Prerequisite or Concurrent: None**

**Number of the credits: 1**

**Course Type: Theoretical**

**General Aims of the Course:**

At the end of the course, the student will be familiar with the theories of color vision and their mechanisms, how to use various color vision and visual sensitivity tests, the advantages and disadvantages of each of them, and the effect of various diseases on color vision and visual sensitivity, as well as various types of color vision defects.

**Course Description:**

Correct diagnosis and measurement of color vision is very important in today's careers. Congenital color vision disorders are seen in all groups and races. In this course, the types of color vision disorders, types of anomaloscopes, isochromatic-like tests, Farnsworth color project diagnostic tests, lantern tests, and their theoretical principles are presented to the student.

**Outline (17 theoretical hours):**

- Introduction to the sensory aspects of light and color
- Differentiation of psychophysical methods
- Spectral responses of the eye
- Mechanisms of sensitivity control
- Accustoming to light
- Separating colors from each other, normal and defective mechanisms of color vision
- Neurophysiology of color recognition
- Perception of light and color
- Color coding
- Light sources
- Filters
- Theories of color vision and normal color vision

- Evolution of color vision
- Color vision disorders and their prevalence
- Performing diagnostic tests
- Color vision examination in children
- Computerized tests for color vision diagnosis - Color vision in various diseases
- Medicines and color vision

**References:**

1. Birch J. Diagnosis of defective colour vision. Butterworth-Heinemann, Latest edition.
2. Conway BR. Neural mechanisms of colour vision. 1<sup>st</sup> ed. Springer, 2010.
3. Jennings JE. Color-vision and colour-blindness. General books LLC, 2010.

**Student Assessment:**

Class activities: 20% of total grade

Midterm exam: 30% of total grade

Final written exam: 50% of total grade

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**Course name: Molecular cellular basis of vision**

**Course**

**Code: 20**

**Prerequisite or Concurrent: None**

**Number of credits: 2**

**Course Type: Theoretical**

**General Aims of the Course:**

Improving the student's knowledge in understanding the cellular and molecular foundations of the visual system

- 1 - Understanding the principles of genetics
- 2 – Cellular-molecular diagnostic methods
- 3 - Molecular principles of vision at different levels of the visual system
- 4 - Diagnostic methods for genetic disorders in the visual system
- 5 - The effect of light stimulation on the growth and development of brain neurons
- 6 - Neuroplasticity of the visual system

**Course Description:**

To better understand the process of neurological growth and development of the visual system

- 1 – Cellular-molecular understanding of the visual system
- 3 - Understanding the principles of brain mapping
- 4 - Understanding diagnostic methods for visual cortex activities
- 5 - Understanding the principles of clinical cellular-molecular tests
- 6 - Familiarity with diagnostic methods for genetic disorders in the visual system

**Outline: (34 theoretical hours)**

**Genetics in**

- 1 - Retina
- 2 - Central nervous system
- 3 - Understanding the principles of brain mapping
- 4 - Diagnostic methods for visual cortex activities at the cellular-molecular level
- 5-Diagnostic methods for disorders of retinal and visual cortex activity
- 6-The effect of visual stimulation on the growth and development of brain neurons
- 7-Cellular-molecular principles of amblyopia
- 8-Visual system plasticity
- 9-elective attention in aging Neglect

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**References:**

- 1- Molecular and Cellular Basis of Visual Acuity (The Cell and Developmental Biology of the Eye) by S.R. Hilfer and J.B. Sheffield (1984)
- 2- Molecular biology of the eye: Genes, vision, and ocular disease: (latest edition)
- 3- Molecular Mechanisms in Visual Transduction, Volume 3 (Handbook of Biological Physics) by D.G. Stavenga, W.J. de Grip, and E.N. Pugh (latest edition)
- 4- Developing Brain Behavior: The Role of Lipids in Infant Formula by John Dobbing latest edition
- 5- Classics in Vision Research: Cellular and Molecular Biology of the Retina v.1 (Vol 1) by Dominic Man-Kit Lam (latest edition)
- 6- Photoreceptors and Light Signaling (Comprehensive Series in Photochemical & Photobiological Sciences) by A. Batschauer (2004)
- 7- Visual Perception: A Clinical Orientation by Steven H. Schwartz (2004)

**Student Assessment:**

Written Midterm Exam: 40%

Seminar and course project: 20%

Final Exam: 40%

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**Course name: Neuroscience in vision  
21**

**Course code:**

**Prerequisite or Concurrent: None**

**Number of credits: 2**

## **Course Type: Theoretical**

### **General Aims of the Course:**

To acquire knowledge and improve the scientific level in understanding neuroscience and general neuronal fundamentals:

- 1 - The structure of the neuron membrane and its physiological activities
- 2 - Action Potential, theory, how neurons work, axons and dendrites
- 3 - Synaptic Transmission - Synaptic structure, how they work, neurotransmitters, especially those involved in the visual system, how drugs affect them
- 4- Presynaptic mechanisms of synthesis, storage, release and inactivation of neurotransmitters
- 5 - Postsynaptic mechanisms including neurotransmitter receptors.

**Course Description:** It is necessary to better understand visual processes and to know the principles of neuroscience in the field of neuronal development of the brain and spinal cord in general.

### **Outline: (34 theoretical hours)**

#### **Brain and spinal cord neuroscience**

- 1- Introduction to neuroscience, its evolution
- 2- Neurons and glia, including the structure of neurons and how they function
- 3- The structure of the neuron membrane and its physiological activities
- 4- Action Potential Theory, how neurons work, axons and dendrites
- 5- Synaptic Transmission - Synaptic structure, how they work, neurotransmitters, especially those involved in the visual system, how drugs affect them
- 6- Presynaptic mechanisms, synthesis storage, release and inactivation of neurotransmitters
- 7- Postsynaptic mechanisms, including neurotransmitter receptors
- 8- The consequences of signal transmission
- 9- Neuronal Integration

10- Synaptogenesis including neurogenesis, synapse formation, axon migration, growth and development

11 - Structure of the central nervous system

12 - Sensory and motor systems of the brain including: the taste system - visual, auditory system, balance, motor control of the spinal cord and brain

13 - Supranuclear and subnuclear centers and advanced visual mechanisms

**References:**

1- Applications of Parallel Processing in Vision (Advances in Psychology) by J.R. Brannan (1992)

2- Neuroscience Exploring the brain, 2nd ed, Mark F. Bear 2001, Lippincott Williams & Wilkins.

3- The Neurology of Vision (Contemporary Neurology Series) by Jonathan D. Trobe and Tanya K. Leonello (2001)

4- Pediatric Neuro-Ophthalmology by Michael C. Brodsky (2010)

5- Essential Neuroscience Allan Siegel, 2006, Lippincott Williams & Wilkins.

6- Neuroscience Dale Purunes et al 2nd ed. 2001, Sinaver Associate

7- Short protocols in neurosciences cellular and molecular methods Charles R. Gerfen Michael A.

Rogawski 2006 by John wiley and Sono, Inc.

8- Short protocols in neurosciences systems and behavioral methods by Jacqueline N. Crawely 2007 John wiley & Sono, Inc.

9- the latest print of all above books

**Student Assessment:**

Midterm Written Exam: 40%

Class Conference: 20%

Final Exam: 20%

Ministry of Health and Medical Education, Supreme Planning Council of Medical Sciences, Islamic Republic of Iran