



# NIMS UNIVERSITY

SYLLABUS  
OF

MASTER OF OPTOMETRY & OPHTHALMIC TECHNOLOGY –  
MOOT

VERSION 2.0

DIRECTORATE OF DISTANCE EDUCATION

Shobha Nagar, Jaipur-Delhi Highway (NH-11C), Jaipur- 303121  
Rajasthan, India

# MASTER OF OPTOMETRY & OPHTHALMIC TECHNOLOGY – MOOT

Eligibility	:	BOOT/BPT/BOT
Programme Duration	:	2 Years
Programme Objectives	:	<p>The scope of Optometry includes the detection of common eye diseases, the management of binocular vision problems such as squints and lazy eyes and the prescription of spectacles and contact lenses. The Masters degree in Optometry is a programme that aims to produce professionally competent optometrists serving as primary eye care health practitioners. NIMS University is one of the few premium institutions in India that offers a Masters degree in Optometry and Ophthalmic Technology.</p>
Job Prospects	:	<p>After the completion of BOOT, you will find challenging career opportunities with Optician shops, eye doctors, and Contact Lens companies, Ophthalmic lens industry and hospital eye departments. A technician can work for eye testing, Contact lenses, squint exercises, etc. You can start your own eye clinic, Optical shop, lens manufacturing unit. You can also get job opportunities with Optician shops and hospitals in India and abroad. Additionally, you can take up teaching Optometry as a career with schools of Optometry. Common job profiles of students after completing BOOT include: Optometry and Ophthalmic Heads, Technicians, Ophthalmic Head Nurses and Academic positions.</p>

**YEAR I**

<b>Course Code</b>	<b>Course Title</b>	<b>Theory/ Practical</b>	<b>Continuous Assessment (Internals)</b>	<b>Credits</b>
OPH16108	Applied and Clinical Optometry	70	30	4
OPH16109	Ophthalmic Neuroscience and Visual Perception	70	30	4
OPH16110	Vision Ageing and Low Vision Aids	70	30	4
OPH16111	Nanotechnology in Ophthalmology	70	30	4
OPH16112	Orthoptics and Pleoptics	70	30	3
OPH16113	Recent Advancement in Optometry and Management of OT	70	30	3
OPH16114	Physical, Visual and Geometric Optics	70	30	2
OPH16108P	Applied and Clinical Optometry (P)	35	15	2
OPH16110P	Vision Ageing and Low Vision Aids (P)	35	15	2
OPH16112P	Orthoptics and Pleoptics (P)	35	15	2
OPH16114P	Physical, Visual and Geometric Optics (P)	35	15	2
	<b>Total</b>		<b>900</b>	<b>32</b>

**YEAR II**

<b>Course Code</b>	<b>Course Title</b>	<b>Theory/ Practical</b>	<b>Continuous Assessment (Internals)</b>	<b>Credits</b>
OPH16208	Occupational Optometry and Community Ophthalmology	70	30	5
OPH16209	Contact Lens	70	30	4
OPH16210	Ocular Diseases and Ocular Pharmacology	70	30	4
OPH16211	Refractive Surgeries and Eye Banking	70	30	4
OPH16212	Ophthalmic, Optometric and Optical Instruments	70	30	5
MIN16201	Medical Informatics	70	30	4
OPH16209P	Contact Lens (P)	35	15	2
OPH16212P	Ophthalmic, Optometric and Optical Instruments (P)	35	15	2
DSR16201	Dissertation		100	2
	<b>Total</b>		<b>800</b>	<b>32</b>

# DETAILED SYLLABUS

**INSTRUCTIONAL METHOD:** Personal contact programmes, Lectures (virtual and in-person), Assignments, Labs and Discussions, Learning projects, Industrial Training Programmes and Dissertation.

## YEAR I

### APPLIED AND CLINICAL OPTOMETRY – OPH16108

UNIT	CONTENT
1	<b>Pediatric Optometry:</b> Paediatric communication; History - Genetic factors, Prenatal factors, Perinatal factors, Postnatal-factors.
2	<b>Pediatric Visual Acuity Measurement:</b> Measurement of visual acuity.
3	<b>Normal Appearance, Pathology and Structural Anomalies:</b> Orbit; Eyelids; Lacrimal system; Conjunctiva; Cornea; Sclera; Anterior chamber; uveal tract; pupils; Lens; vitreous; fundus.
4	<b>Pediatric Refractive System Measurement:</b> Measurement of the refractive system; Oculomotor system pertaining pediatric optometry.
5	<b>Compensatory Treatment and Remedial Therapy:</b> Myopia; Pseudomyopia; Hyperopia; Astigmatism; Anisometropia; Amblyopia; Remedial and compensatory treatment for strabismus and nystagmus.
6	<b>Pediatric Optometry:</b> Vergence and accommodation; Delayed development; Spectacle dispensing.
7	<b>Paediatric Contact Lenses, Assessment of Low Vision and Management:</b> Paediatric contact lenses; Low vision assessment and management.
8	<b>Geriatric Optometry:</b> Structural changes of the eye; Physiological changes of the eye.
9	<b>Ocular Diseases of Geriatric Patients:</b> Ocular diseases common in the old eye with special reference to cataract; glaucoma Macular disorders; vascular diseases of the eye etc.

**LEARNING SOURCE:** Self Learning Materials

#### **ADDITIONAL READINGS:**

- A. Agarwal, R., Integrating theory with practice, Optician, Volume 236, 2008.
- B. Agarwal, R. Developing the doctorate, Optician, volume 247, 2014.
- C. Mitchell DE, Timney B. Postnatal development of function in the mammalian visual system. Williams & Wilkins.

#### **WEB LINKS:**

- A. [http://www.childrensmemory.org/Clinics\\_and\\_Services/Clinics\\_and\\_Departments/Ophthalmology/What\\_is\\_Pediatric\\_Optomety\\_/](http://www.childrensmemory.org/Clinics_and_Services/Clinics_and_Departments/Ophthalmology/What_is_Pediatric_Optomety_/)
- B. <http://en.wikipedia.org/wiki/Optomety>
- C. <http://www.wisegeek.net/what-does-a-developmental-optometrist-do.htm#didyouknowout>

## APPLIED AND CLINICAL OPTOMETRY (P) – OPH16108P

1. Measurement of corneal thickness.
2. Measurement of axial length of the eye Calculation of intraocular lens power.
3. Assessment of corneal sensitivity.
4. Assessment of Lacrimal passage.
5. Measurement of margin reflex distance.
6. Measurement of tear volume.
7. Determination of tear film break-up time.
8. Measurement of tear prism height.
9. Amsler grid test.

## OPHTHALMIC NEUROSCIENCE AND VISUAL PERCEPTION – OPH16109

UNIT	CONTENT
1	<b>Ophthalmic Neuroscience:</b> Electrophysiology of the nerve cells (resting and action potential, synapses, receptors); Neuroanatomy (brain, cranial nerves, spinal cord, autonomic nervous system), and Neurophysiology (reflexes, pain and sensation, vestibular system, proprioceptive sensation, autonomic nervous system).
2	<b>Basic About Visual Perception:</b> Early studies; Higher integrative activity, Binocular perception, stereoscopic depth perception; Neurophysiology of perception – Higher visual pathways (primary visual Pathway to cerebral center, Lateral Geniculate body, non-geniculate targets for retinofugal input, visual center); Neurophysiology of perception – Spatial analysis, Double pathway to higher visual centers.
3	<b>Visual Perception:</b> Colour perception; Chromatic discrimination (hue and saturation) for normal defective colour vision; Colour mixture and appearance; Colour contrast; constancy and adaptation; Colour specification and colorimetry (CIE); Spectral sensitivity of normal and defective colour vision; Mechanisms of colour deficiencies.
4	<b>Physiology of Binocular Vision:</b> Binocular Vision - Grades of Binocular Vision, Advantages of Binocular Vision; Evolution of Binocular Vision - Visual Directions, Corresponding points, Horopter and Physiologic Diplopia, Binocular Fusion and Panum's area, Dichoptic Stimulation, Stereopsis, Depth perception, Integration of motor and sensory system; Development of Binocular Vision – Prerequisites, Eye at birth and normal postnatal development, Maturation of Binocular function, Neurophysiology of development, Theories of development, Disturbances in the development
5	<b>Form Perception:</b> Static visual acuity (including test configuration, various acuity tasks, and factors influencing acuity including blur, intensity and contrast), specification of visual acuity; Spatial contrast sensitivity function (including factors influencing the function) illusions, constancies, and figure-ground relations; Simultaneous contrast and spatial interactions (Mach bands).
6	<b>Light Perception:</b> Detection characteristics at the absolute light threshold (including spectral, spatial, and temporal aspects); Brightness-difference thresholds at various adaptation levels (Weber's and DeVries-Rose Laws), specification of contrast; Dark and light adaptation processes and theories; Spatial and temporal summation characteristics (Ricco's, Piper's and Bloch's Laws).
7	<b>Motion Perception:</b> Factors involved in the detection of real and apparent motion, detection of displacements; Motion after-effects; Dynamic visual acuity, visual performances with a moving object, and visual performances with a moving observer.

8	<b>Temporal Perception:</b> Critical flicker fusion frequency, including influencing factors (test object size, location and adaptation level); Sub-fusional flicker phenomena (Bartley brightness enhancement); Successive contrast and masking; Temporal contrast sensitivity function; Stabilized retinal images and monocular suppression (Troxler effect); Saccadic suppression.
9	<b>Entoptic Phenomena:</b> Characteristics and origin of various phenomena (involving the cornea, lens, and vitreous); Vascular and circulatory phenomena (Purkinje tree, capillary circulation); Phenomena associated with central vision (Maxwell's spot, Haidinger's brushes); Phenomena associated with retina, distention or other forms of retinal activity (Moore's lightning streaks, blue arcs of the retina, phosphenes); After Image – Types, Visualization, Factors affecting After Images, Physiological basis.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Neuroscience in Medicine- By Michael Conn
- B. Scholz J, Klein MC, Behrens TEJ and Johansen-Berg H. Training induce changes in white matter architecture. Nature
- C. Neuroscience. 2009, 12: 1370-1371.

**WEB LINKS:**

- A. <http://www.ybu.edu.tr/sinancanan/contents/files/659Physiology-of-Balance.pdf>
- B. <http://www.bcs.rochester.edu/courses/crsinf/504/ARCHIVES/F05/ch27.pdf>
- C. [http://cbc.ucsd.edu/pdf/Percpt\\_Apprnt\\_Mot\\_Sci\\_Am.pdf](http://cbc.ucsd.edu/pdf/Percpt_Apprnt_Mot_Sci_Am.pdf)

## **VISION, AGEING AND LOW VISION AIDS – OPH16110**

UNIT	CONTENT
1.	<b>Vision and Ageing:</b> Normal vision development in the infant and child; Normal motor development in the infant and child; Normal cognitive and social development in the infant and child; Effects of early environmental restrictions; Normal changes in vision with ageing; Anomalies of Child Development; Clinical techniques and tests to assess the development of children at various ages; Clinical characteristics of children who deviate from normal patterns of development and epidemiology of developmental disorders; Tests that diagnose vision problems which may be associated with deviations from normal patterns of development; Clinical management of ageing patients with multisensory loss; Assessment of the need for referral and consultation with other disciplines; Colour vision anomalies by type and prevalence; Colour vision tests used for both screening and diagnosis of congenital colour vision anomalies; Conditions for colour vision testing; Societal implications of colour vision anomalies; Assessment of the need for referral and consultation with other disciplines.
2.	<b>Role of the Optometrist:</b> Managing and referring children who deviate from normal patterns of development; Anomalies of the Ageing Adult; Clinical characteristics of changes in perceptual function (non-visual) associated with ageing; Symptom profiles, clinical procedures and tests identifying changes in vision; Tests used by optometrists to determine a child's level of visual-perceptual development.
3.	<b>Introduction to Low Vision:</b> Definitions and Regulations of Low Vision,

	Definition of Low Vision, Visual disorder, Visual impairment, Visual handicap, Social and Legal blindness; Incidence and Prevalence of Low Vision; Low vision examination, Low vision History, Assessment of Functional Vision, Low Vision refraction, Clinical Examinations; Enhancement of Visual Performance, Illumination and Lighting Eccentric viewing and steady eye strategy, Environmental modification.
4.	<b>Visual Disorders Causing Low Vision:</b> Disease Process; Visual disturbances caused by ocular pathologies; Eye conditions causing low vision based on the structure involved.
5.	<b>Optical Low Vision Devices:</b> Low Vision Devices for distance, Galilean Telescope, Keplerian Telescope, Comparison between Galilean and Keplerian Telescope; Low Vision devices for near, Magnification: Under this subtopic describe Relative distance magnification, Relative size magnification and Angular Magnification in different pints, Spectacle Magnifiers Magnifiers, Stand Magnifiers, Hand Magnifiers: Describe optics, advantages, disadvantages and power ranges of Stand Magnifiers, Bar Magnifiers: Describe optics, advantages, disadvantages and power ranges of Bar Magnifiers, Dome Magnifiers: Describe optics, advantages, disadvantages and power ranges of Dome Magnifiers.
6.	<b>Non-optical Low Vision Devices:</b> Relative size and larger assistive devices; Glare control and lighting control devices, Illumination Control, Filters, Antireflection Coated lenses, Polarized lenses, Pinhole Spectacles; Posture and Comfort maintaining devices; Handwriting and written devices; Orientation and mobility management devices, Sighted guided technique, Canes, Dog guide, Field enhancements; Sensory Substitution Devices, Auditory Substitutions, Tactile Substitutions.
7.	<b>Electronic Low Vision Devices:</b> Closed Circuit Television - Basic Components, Latest advancements, Magnification, Equivalent power, Advantages, Disadvantages; Electronic Travel aids - ETAs using active sensors, ETAs using passive sensors, Image Processing based passive Electronic Travel Aids.
8.	<b>Prescribing Low Vision Devices:</b> Prescribing Spectacle for Low Vision patient; Prescribing high plus lenses Prescribing high minus lenses; Prescribing high cylinder; Prescribing addition for Low Vision patient; Prescribing Telescope; Calculating magnification for Telescope; Training and instructions for a patient while prescribing telescope; Prescribing Magnifiers at near; Calculating Magnification for Magnifiers; Factors to be considered while calculating magnification; Instructions to be given while prescribing Magnifier.
9.	<b>Rehabilitation Services:</b> Definition; Implementation; Vocational guidance and educational guidance; Mobility & orientation training- special teacher, special school, Braille system, integrated system, referral center- activity, support, loan.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. "About Clinical Psychology". apa.org. American Psychological Association, Division 12, Society of Clinical Psychology.
- B. Shaffer, D. R., Wood, E., & Willoughby, T. (2005). Developmental psychology: Childhood and adolescence. Toronto, Ontario: Nelson Education Canada.
- C. Patterson, Charlotte (2008). Child development. Boston: McGraw-Hill Higher Education.

**WEB LINKS:**

- A. [http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Child\\_development\\_\(5\)\\_one\\_to\\_two\\_years](http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Child_development_(5)_one_to_two_years)
- B. <http://www.ukoptometry.co.uk/wp-content/premium/sosena-tang-cet-09-final.pdf>
- C. <http://www.bmj.com/content/346/bmj.e8687>

**VISION, AGEING AND LOW VISION AIDS (P) – OPH16110P**

1. Recording of Visual Acuity in Low Vision patient.
2. Color vision testing by D15 color vision plates.
3. Brightness acuity testing.
4. Radical Retinoscopy in patient with low vision.
5. Identification of telescope.
6. Macular function test by Potential Acuity Meter.

**NANOTECHNOLOGY IN OPHTHALMOLOGY – OPH16111**

UNIT	CONTENT
1	<b>Introduction:</b> Nano-ophthalmology; Nanotechnology and ophthalmology; Nanomedicine; Nanoneurology.
2	<b>Nanotechnology and the Health Care:</b> Nanotechnology and drug delivery; New surgical techniques.
2	<b>NIH/NEI and Nanotechnology:</b> Brief about NIH/NEI and nanotechnology.
3	<b>Some Applications of Nanotechnology to OPHTHALMOLOGY:</b> Treatment of disease states: oxidative stress; Noninvasive biophysical measurement: intraocular pressure; Coupling disease measurement and treatment: theragnostics.
4	<b>Future of Nanomedicine and Vision Research:</b> Drug delivery; DNA repair; Retinal neuro-prostheses; Imaging; Diagnostics; Lens replacements; Corneal repair; Neural repair – nano-knitting and nano scaffolding.
5	<b>Gene &amp; Cell Delivery to the Eye:</b> Brief about Nanotechnology, gene and cell delivery to the eye.
6	<b>Ophthalmic Applications of Emerging and Converging Technologies:</b> Nanoshells; Nanotubes; Nanocarriers; Nanomicelles; Memristors; Lasers: Introduction, Types of laser in ophthalmology, safety in lasers.
7	<b>Nanotechnology and Robotics Alternatives for Therapy:</b> Retinal implant; Intelligent contact lenses.
8	<b>Applied Nano-ophthalmology:</b> Nanofibers combat glaucoma; Nano-bubble; delivering drug.
9	<b>Biomedical Nanosystems Marketed for Human Use:</b> Abraxane; Combixel; Doxil; Emend; Ferridex; Gastromark; Macugen; Rapamune.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Nanotechnology: Importance and Applications, By M.H. Fulekar, 2010
- B. Innovative Techniques in Ophthalmology, by Garg, 2006



C. The Eye in History, By Frank Joseph Goes, 2013

**WEB LINKS:**

- A. <http://books.google.co.in/books?id=QQQ1biZq5BQC&pg=PA402&dq=nanotechnology+in+ophthalmology&hl=en&sa=X&ei=Bmu2U429D4b6oATmmICoCA&ved=0CDcQ6AEwAw#v=onepage&q=nanotechnology%20in%20ophthalmology&f=false>
- B. <http://www.touchneurology.com/articles/nanotechnology-neurology-current-status-and-future-possibilities?page=0,3>
- C. <http://books.google.co.in/books?id=PdAsuzFRv5oC&pg=PT732&dq=nanotechnology+in+ophthalmology&hl=en&sa=X&ei=UGy2U5-iC4n98QXh84KIBw&ved=0CCkQ6AEwAQ#v=onepage&q=nanotechnology%20in%20ophthalmology&f=false>

**ORTHOPTICS AND PLEOPTICS – OPH16112**

UNIT	CONTENT
1	<b>Investigation of Normal Binocular Function and Vision:</b> History and assessment of Deviation - History taking, Determination of Deviation, Measurement of Deviation; Assessment of Vision - Estimation of Visual Acuity in Infants, Assessment of Visual Acuity in Preschool Children, Assessment of Visual Acuity in School-age Children; Accommodation/Convergence: Types of Convergence; Accommodative Lead & Lag; Relative Convergence & Accommodation; AC/A & CA/C Ratios; Classification of Convergence & Accommodation Anomalies; Management of Convergence & Accommodation Anomalies; Relevance to Strabismus. Assessment of Fusion and Motor function of the eye - Measurement of Fusional Vergence, Measurement of Near Point of Convergence, Measurement of Near Point of Accommodation, Extra-ocular Motility test, Tests for Fusion; Assessment of Stereopsis: Types of Stereotests; Application to Age Group & Quality of BSV.
2	<b>Heterophoria:</b> Classification; Aetiology – Esophoria, Exophoria, Hyperphoria / Hypophoria, Cyclophoria; Causes of Decompensation; Investigations; Dissociated Heterophoria; Indications for management; Management.
3	<b>Suppression, Anomalous Retinal Correspondence and Amblyopia:</b> Suppression – Definition, Mechanism, Investigations, Management; Anomalous Retinal Correspondence – Definition, Mechanism, Classification, Investigation, Management; Amblyopia – Definition, Classification, Aetiology, Investigations, Management.
4	<b>Heterotropia:</b> Classification of Esotropia - Microtropia; Infantile; Nystagmus Blockage Syndrome; Acquired Constant Esotropia; Intermittent Esotropia: Near; Distance & Non-specific; Accommodative Esotropia: Fully Accommodative; Convergence Excess; Partially Accommodative Esotropia; Cyclic Esotropia; Secondary Esotropia; Consecutive Esotropia. Classification of Exotropia - Infantile Exotropia; Constant Acquired Exotropia; Intermittent Exotropia - Near; Distance; Secondary Exotropia; Consecutive Exotropia; Associated Vertical Deviations, Clinical Characteristics & Differential Diagnoses of Esotropias & Exotropias; Assessment of Binocular Function in Heterotropia and Significance of Findings; Associated Alphabetical Patterns and influence on Findings; Optical, Orthoptic & Surgical Management of Heterotropia, including Timing of Intervention.
5	<b>Infranuclear Deviations:</b> Functions of EOM - Primary, Secondary & Tertiary actions; OM systems; Examination of EOM function & systems; Examination of versions / ductions; Hess / Lees screens; Field of BSV; Field of Uniocular Fixation. Muscle sequelae; Differential Diagnosis of Neurogenic / Mechanical Palsies.
6	<b>Neurogenic Palsies:</b> Aetiology of Cranial Nerve Palsies - Diagnosis & Characteristics of

	IIIN Palsy; Partial / Complete IIIN palsy; Differential Diagnosis of Congenital/ Acquired IIIN Palsy; Misdirection Syndrome; Management of IIIN Palsy; Characteristics & Diagnosis of IVN Palsy; Differential Diagnosis of Congenital/Acquired IVN Palsy; Bielschowsky Head Tilting Test; Park's Three Step Test; Management of IVN Palsy; Characteristics & Diagnosis of VIN Palsy; Differential Diagnosis Congenital/Acquired VIN Palsy; Differential Diagnosis of Congenital VIN Palsy & Duane's Retraction Syndrome; Management of VIN Palsy.
7	<b>Mechanical Palsies:</b> Aetiology, Clinical Characteristics & Diagnosis of Duane's Retraction Syndrome; Aetiology, Clinical Characteristics & Diagnosis of Brown's Syndrome; Aetiology, Clinical Characteristics & Diagnosis of General Fibrosis Syndrome; Strabismus Fixus; Adherence Syndrome; Aetiology, Clinical Characteristics & Diagnosis of Blow-out Fractures; Aetiology, Clinical Characteristics & Diagnosis of Thyroid Eye Disease; Management of Mechanical Deviations.
8	<b>Internuclear Palsy:</b> Aetiology, Clinical Characteristics & Diagnosis of Internuclear Palsies; Unilateral / Bilateral INO; Management of INO; <b>Supranuclear Palsy:</b> Aetiology, Clinical Characteristics & Diagnosis of Supranuclear Palsies; Management of Supranuclear Palsies.
9	<b>Anomalies of Binocular Vision in Congenital Syndromes:</b> To include: Marcus Gunn Jaw-Winking phenomenon; Down's Syndrome; Cerebral Palsy; Craniofacial Anomalies.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Ing MR, Okino LM. Outcome study of stereopsis in relation to duration of misalignment in congenital esotropia. J AAPOS 2002;
- B. Ing MR, Rezentes K. Outcome study of the development of fusion in patients aligned for congenital esotropia in relation to duration of misalignment. J AAPOS 2004; 8:35-7.
- C. Kim JS. Internuclear ophthalmoplegia as an isolated or predominant symptom of brainstem infarction. Neurology 2004; 62:1491.

**WEB LINKS:**

- A. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1014128/>
- B. <http://www.uptodate.com/contents/binocularvision>
- C. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1014128/>

**ORTHOPTICS AND PLEOPTICS (P) – OPH16112P**

1. Prism bar cover test.
2. Demonstrating and operating Synoptophore.
3. Determination of ocular deviation by synoptophore.
4. Visuoscopy.
5. Measurement of accommodative facility.
6. Diplopia charting.
7. Park's Three Step Test.
8. Hess charting.
9. Procedures of convergence exercises.

## RECENT ADVANCEMENT IN OPTOMETRY AND MANAGEMENT OF OT – OPH16113

UNIT	CONTENT
1.	<b>Recent Advances in Optometry:</b> Introduction; Ray Optics; Helmholtz equation; Beam Optics - Introduction, Gaussian Beams, Other solution of Helmholtz equation, Short duration beams, Alternate method for describing a beam: covariance matrix and $M^2$ .
2.	<b>Fourier Optics:</b> Harmonic analysis of a signal; Amplitude and phase modulations; Transfer function of free space; Optical Fourier transform; Diffraction & Interference; Image shaping; Holography.
3.	<b>Electromagnetic Description of Light &amp; Propagation in Matter:</b> Light in vacuum; Theory of electromagnetic beams; Light guiding; Absorption of light & Dispersion; Optical phenomena in nonisotropic media - Dichroism and birefringence, E-field effects, Acousto-optics effects, B-field effects.
4.	<b>Laser and Light Sources:</b> Interaction of light with matter; Laser dynamics; Laser Oscillator; Laser tailoring and pulse generation; Steady-state; Pulsed laser beam; Amplifiers, Optical amplifier, Example of laser systems; Radiation from moving charged particle-Synchrotron Radiation; Synchrotron radiation; Undulator radiation; Free-electron laser; Thomson scattering.
5.	<b>Non-linear Optics:</b> Nonlinear optical media; 2 <sup>nd</sup> order optics; 3rd order optics; wave mixing; high harmonic generation; self-focusing and phase modulation.
6.	<b>Introduction to Statistical Optics:</b> Statistical properties of random light; Interference of partially polarized coherent light; Transmission of partially coherent light through optical system; Partial polarization.
7.	<b>Advances in Vision Technology:</b> Discussion over Bionic eye; Retinal Implant, Implantable Miniature Telescope.
8.	<b>Corneal Collagen Cross Linking:</b> Introduction; Cross linking; Physiology of collagen corneal cross linking; Current scenario and Future prospects.
9.	<b>Management of OT:</b> Introduction to Ocular in general; Asepsis and Disinfection; 0 T Sterilization procedure - Definition, Physical methods, Chemical methods; Sterilization procedures of 0 T Instruments; Maintenance of Instruments and equipment: Ophthalmic Instruments; Maintenance of Instruments and equipment's: Orthoptics Instruments; Maintenance of Instruments and equipment- Surgical Instruments; Maintenance of Instruments and equipment- Optometric & Contact Lens Equipment.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Quantum Optics, D.F. Walls, Gerard J. Milburn, 2008
- B. Optical Coherence and Quantum Optics, Leonard Mandel, Emil Wolf, 1995
- C. Optometry: Science, Techniques and Clinical Management, Butterworth-Heinemann; 2009

**WEB LINKS:**

- A. <https://wiki.engr.illinois.edu/download/attachments/220431329/Quimby+pp+307+to+318.pdf?version=1&modificationDate=1358205699000>
- B. <http://mathworld.wolfram.com/Covariance.html>
- C. <http://www.physics.nus.edu.sg/pc2193/Experiments/lab.pdf>

## PHYSICAL, VISUAL AND GEOMETRIC OPTICS – OPH16114

UNIT	CONTENT
1	<p><b>Nature of Light:</b> Wave nature of light – short comings of wave theory; Quantum theory – dual nature of light; Mathematical representation of wave – S.H.M; Energy composition of S.H.M. in a straight line and at right angles; Huygen’s Principle – Laws of reflection and refraction at spherical surfaces and lenses; The paraxial region; Ray and wave velocity; Principles of Lighting; Visual Tasks – Factors affecting Visual tasks; Modern theory on light and colour synthesis of light; Additive and subtractive synthesis of colour; Light sources – Modern light sources, spectral energy, distribution, luminous efficiency, colour temperature, colour rendering; Illumination – Luminous flux, candela, solid angle; Illumination – Utilization factor, depreciation factor; Illumination laws; Lighting installation – glare, luminaries, lighting fixtures, types of lighting; Requirements for illuminations of work place; Typical lighting installations; Specialized aspects of illumination, endoscopes, headlamps etc; Diffraction - single slit, circular aperture, limits of resolution, zone plates; Interference: (double slit, multiple slits, thin film, antireflective coatings, holography); Scattering: (Rayleigh compared to Tyndall); Dispersion; Interaction of light and matter; Atomic energy levels, absorption and emission line spectra; Continuous spectra (Black body radiator and gray body radiator characteristics); Fluorescence: (photons, energy levels); Lasers: (theory of operation, speckle pattern); Spectral transmission.</p>
2	<p><b>Polarization:</b> Polarization of transverse waves – light as transverse waves; Double refraction, principal plans, Nicol prism – plane polarization; Circular, elliptic polarization production, detection and behavior; Effects of scattering on polarization, Optical activity – Fresnel’s half shade polarimeter; Polarization by selective absorption – dichorism; Basic principles of Holography.</p>
3	<p><b>Refraction Through Spherical Surfaces:</b> Introduction – Lens shapes, vergences and conversion factors; Divergence and secondary focal points – predictable rays; Spherical refracting interfaces – convex, concave, derivation of vergence equation, sagittas, and dioptric power – focal points, nodal points and plane; Symmetry point imaging examples, lateral magnification; Thin lens equation – lenses in contact separated; Two lens systems – reduced systems using vergence techniques; Application – calculation of image points, dioptric powers in reduced systems using vergence techniques; Thick lenses – front and back vertex powers – reduced system –dioptric power of equivalent lenses, cardinal points; Application to calculate the equivalent dioptric power of thick meniscus lens; Plano convex, vertex powers, position of principal planes, dioptric powers using reduced systems; Matrix theory and lens matrices.</p>
4	<p><b>Radiation and the Eye:</b> Radiometry (radiant, intensity, radiance, and irradiance); Photometry (Luminosity function, luminous intensity, luminance, and illuminance, Lambertian surfaces-cosine laws); Spectral transmission of the ocular media; Retinal illuminance; Effects of radiation (especially infrared, visible and ultraviolet).</p>
5	<p><b>Aberrations:</b> Chromatic aberrations – dispersion without deviation and deviation with dispersion; Dispersion by a prism – angular dispersion – dispersion power – dispersion without deviation and deviation without dispersion; Achromatic prisms and lenses – prism diopters; Monochromatic aberrations – first order and third order theory; Spherical aberrations, coma, astigmatism, curvature, distortion – cause and the methods of minimizing aberrations; Tangent condition for elimination of distortion.</p>
6	<p><b>Fiber Optics &amp; Optical Instruments:</b> Introduction and uses, general applications in Ophthalmic &amp; Optical industry; Optical instruments – spectrometer, simple and compound microscope, telescope; Fresnel’s biprism; Resolving power of optical instruments, Dispersion power, magnifying power of simple and compound microscope, telescope; Applications of vergence technique to calculate dioptric powers, separation distances in microscopes and telescopes.</p>

7	<b>Review of Geometrical Optics:</b> Refraction at single spherical or plane surfaces; Curvature and sagitta; Refractive index and rectilinear propagation; Vergence and dioptric power ; Object-image relationships, including apparent depth ; Ray tracing, nodal point, and nodal ray; Lateral (translinear) and angular magnification; Snell's law of refraction; Spherical refracting surface; Spherical mirror; catoptric power; Optics of Ocular Structure: Cornea, Crystalline lens, aqueous & Vitreous and Schematic and reduced eye.
8	<b>Lens System:</b> Thin lenses; Vergence: dioptric and effective power; Object-image relationships; Lateral (translinear) and angular magnification; Thin lens systems: Prismatic effect (Prentice's rule and prism effectivity); Ray tracing, optical center, and optic axis; Thick lenses: Cardinal points; Vertex power and equivalent power; Lateral (translinear) and angular magnification; Reduced systems; Sphero-cylindrical lenses: Location of foci, image planes, principal meridians, and circle of least confusion; Obliquely crossed sphero-cylindrical lenses; Transposition; Prismatic effect.
9	<b>Mirrors:</b> Planar and spherical reflection; Proportion of light reflected from a surface (Fresnel's law); Focal power, focal length, and curvature; Object-image relationships; Magnification; Lens / mirror systems; Ray tracing.
10	<b>Ophthalmic Lenses Manufacturing &amp; Workshop Practice:</b> Prescription laboratory in action; Instruments for making lenses; Outline of lens surfacing and polishing; Recording and ordering of Ophthalmic lenses; Terminology used in Lens workshops; Ophthalmic raw material – history and general outline; Manufacturing of Ophthalmic blanks – Glass; Glass lenses – material types and characteristics. Glass working –spherical surfaces; Glass working – Toric and Aspherical; ISI Standards for lenses; Ophthalmic lens designs – best form lenses; Design of high powered lenses; Bifocal design and manufacture; Absorptive lenses- Colour lenses, Sunglasses, Dying of lenses, Lens Coatings, Photochromatic Lenses, Polarizing Lenses, Glare control lenses.
11	<b>Refractive State of the Eye:</b> Epidemiology, history and symptoms, observation and recognition of clinical signs of- Emmetropia; Myopia; Hyperopia; Astigmatism; Anisometropia and aniseikonia; Accommodation and Convergence - Mechanism of Accommodation, Changes in the eye during Accommodation, Effect of ageing on ciliary muscles Accommodation, Near and Far point of Accommodation, Amplitude of Accommodation, Anomalies of Accommodation, Convergence, Types of convergence, AC/A ratio, Anomalies of Convergence; Aphakia and pseudophakia; Empty field and night myopia; Presbyopia; Effects of ageing on the ciliary muscle and accommodation.
12	<b>Objective and Subjective Refraction:</b> Principles and Methods; Retinoscopy – speed of reflex and optimum condition; Retinoscopy – design consideration; Subjective Refraction - finding Best vision Sphere, determine axis and power of cylinder by JCC, refine sphere, duochrome test, binocular balancing; Over-fogging method; Difficulties in subjective tests and their avoidance; Transposition of lenses; Spherical equivalent.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Louis Desmarais, “Applied Electro-Optics”, Prentice Hall, 1997
- B. Michael V. Berry, “The diffraction of light by Ultrasound”, Academic Press, 1966
- C. Max Born, Emil Wolf, “Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light”, Cambridge University Press, 1999

**WEB LINKS:**

- A. <http://www.physicsclassroom.com/class/light/Lesson-1/Wavelike-Behaviors-of-Light>
- B. <http://physics.about.com/od/lightoptics/a/waveparticle.htm>
- C. <http://micro.magnet.fsu.edu/primer/techniques/fluorescence/fluorescenceintro.html>

## **PHYSICAL, VISUAL AND GEOMETRIC OPTICS (P) – OPH16114P**

1. Study of purkinje images I & II, III & IV.
2. Determination of refractive power by Stenopic slit.
3. Marking the optical center and axis line on a single vision and bifocal lenses.
4. Marking of progressive lenses.
5. Frame measurement: The boxing system, the datum system.
6. Measuring heights: single vision, bifocal and Multifocals Lenses.



YEAR II

**OCCUPATIONAL OPTOMETRY AND COMMUNITY  
OPHTHALMOLOGY – OPH16208**

UNIT	CONTENT
1	<b>Occupational Health:</b> Introduction to Occupational health, hygiene and safety; International bodies like ILO, WHO; National bodies etc, Acts and Rules- Factories Act, WCA, ESI Act.
2	<b>Occupational Vision Services:</b> Primary care optometrist; Eye safety consultation; Vision consultation
3	<b>Performance and Productivity in the Work Place:</b> Vision screening; Ergonomic assessment; Job Requirements and Vision Standards.
4	<b>Ocular Protection:</b> Types of hazards and appropriate protection; Worksite Hazard Assessment; Standards and Regulations for Protection Against Hazards; Eye Emergency Procedures; Contact lens used in the industry.
5	<b>Electromagnetic Radiation and its Effects on Eye:</b> Light– Definitions and units, Sources, advantages and disadvantages, standards; Color– Definition, Color theory, Color coding, Color defects, Color Vision tests.
6	<b>Medico-legal and Ethical Concerns Regarding Standards and Regulations:</b> OSHA standards; Americans with Disabilities Act.
7	<b>Community Optometry - Foundations of Public Health:</b> Course Competencies in Health Promotion; Optometry and the Public Health Association; Public Health in Practice.
8	<b>Principles of Public Health I:</b> Electronic Health Records and Public Health Informatics; Environmental Vision; Epidemiology.
9	<b>Principles of Public Health II:</b> Evidence Based Health Care; Health Promotion and Disease Prevention; Public Health Law; Public Health Optometry Economics; Vision Screening.
10	<b>Governmental Role in Health Care:</b> Community Health Centers; Medicare and Medicaid; State and Local Health Departments; Visual Disabilities.
11	<b>Access and Barriers to Eye and Health Care:</b> Access and Barriers to Health Care; Cultural and Linguistic Competence; Nursing Home Eye Care; Quality Assurance in Optometric Health Care Practice; Vision, Aging, and the Public Health Agenda.
12	<b>World Optometry:</b> Optometry in the Americas; Optometry in Asia; Optometry in Africa; Optometry in Europe.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. David B. Elliott. Clinical Procedures in Primary Eye Care.
- B. Mark Rosenfield, Nicola Logan, Keith H. Edwards. Optometry: Science, Techniques and Clinical Management; Elsevier Health Sciences, 2009 – Medical.
- C. A.K. Khurana, Ophthalmology; New Age International Publisher, 2003.

**WEB LINKS:**

- A. [http://www.nbao.ca/en/eye\\_protection\\_safety.html](http://www.nbao.ca/en/eye_protection_safety.html).
- B. [http://www.islonline.org/team\\_training/Primary\\_Eye\\_Care\\_Manual.pdf](http://www.islonline.org/team_training/Primary_Eye_Care_Manual.pdf).
- C. <http://www.slideshare.net/chandanshettigar/occupational-optometry>.

## CONTACT LENS – OPH16209

UNIT	CONTENT
1	<b>History of Contact Lenses:</b> Related ocular anatomy and physiology, Microbiology & Immunology in relation to contact lens wear; related Visual Optics; Contact Lens materials, terminology, classification; Optics of contact Lenses, comparison spectacles; Indications and contraindications; Advantages and disadvantages of types of Contact lenses; Manufacturing Rigid and Soft Contact lenses – various methods; Pre-Fitting examination – steps, significance, recording of results; Instruments used for examination; Special Investigations in pre-fitting examinations; Keratometry and Cornea; topography; Slit Lamp examination; Discussion with patient, choice of lens type.
2	<b>Fitting Philosophies of Contact Lenses:</b> General outline; Fitting Rigid Contact lenses; Using trial lenses – calculations involved; Methods of assessment of Contact Lens fit; Types of fit – Steep, Flat, Optimum – on spherical cornea; Types of fit – Steep, Flat, Optimum – on Toric cornea with spherical lenses; Types of fit – Steep, Flat, Optimum – on Toric cornea with toric lenses.
3	<b>Calculation and Finalizing of Contact Lens Parameters:</b> Ordering Rigid verifying Contact Lens – writing a prescription to the Laboratory; Checking and verifying Contact Lens from Laboratory; Modifications possible with Rigid lenses; Components of Lens Care systems for Rigid lenses; Contact lens solutions- composition necessity advantages; Teaching the patient to insert and remove Rigid lenses; Common handling instructions to first time wearers; Special instructions to the patient wearing Rigid Gas Permeable Contact Lenses.
4	<b>Special Type of Contact Lenses &amp; Uses:</b> Colour lens, Prosthetic lens, Bandage contact lens, Rose-K, Orthokeratology; Keratoconus: overview & fitting; contact lenses for children.
5	<b>Soft Contact Lens:</b> Law materials, classification, terminology, etc.; Manufacturing Soft Contact Lenses – various methods, advantages & disadvantages; Various designs Soft Contact Lenses - advantages & disadvantages; Pre-Fitting examination – steps, significance, recording of result; Special points for in pre-fitting examination of Soft Contact Lenses; Discussion with patient choice of lens – type; Fitting Soft Contact Lenses general outline; Fitting Soft Contact Lenses – methods –Trial set method; Using trial lenses, calculations involved.
6	<b>Fitting Soft Contact Lenses:</b> First fit method; Methods of assessment of Soft Contact Lenses fit; Types of fit – steep, Flat, Optimum – on spherical cornea; Types of fit – steep, Flat, Optimum – on Toric cornea with spherical lenses; Types of fit – steep, Flat, Optimum – on Toric cornea with toric lenses; Calculation and finalizing of Soft Contact Lenses parameters; Ordering Soft Contact Lenses – writing a prescription to the Laboratory; Fitting Soft Contact Lenses from stock – advantages, limitations, precautions.
7	<b>Checking and Verifying Soft Contact Lenses:</b> Components of Lens care systems for Soft Contact Lenses; Contact lens solutions – composition, necessity, advantages; Teaching the patient to insert and remove soft lenses; Common handling instruction to first time wearers; Special instructions to the patient for using soft lenses; Special soft lenses – cosmetics, Disposable, Toric; Special Rigid Lenses and designs – Toric, Keratoconus, etc.
8	<b>Fitting of Contact Lenses in Special Cases:</b> Children: irregular cornea, Univocal Aphakia, sports one eyes patients post RK, post PRK; Orthokeratology and myopia; Fitting Bifocal and multifocal – RGP & Soft lenses; After care and follow up for all Contact Lens patients; Patient Problems – identification, differential diagnosis and management.
9	<b>Complications of Contact Lenses:</b> Introduction; complications of extended wear soft contact lenses, causes & management.

**LEARNING SOURCE:** Self Learning Materials



### ADDITIONAL READINGS:

- A. WA Douthwaite, "Contact lens optics and lens design". Elsevier Ltd., Edinburgh.
- B. Morgan, Philip B, et al. "International Contact Lens Prescribing in 2010" Contact Lens Spectrum. October 2011.
- C. Leonard G. Schifrin and William J. Rich (December 1984). The Contact Lens Industry: Structure Competition, and public policy.

### WEB LINKS:

- A. <http://www.aclens.com/How-contact-lenses-are-made-c233.html>
- B. <http://www.allaboutvision.com/eye-exam/contact-lenses.htm>.
- C. [http://eyewiki.aao.org/Contact\\_Lenses\\_after\\_LASIK](http://eyewiki.aao.org/Contact_Lenses_after_LASIK).

## CONTACT LENS (P) – OPH16209P

- 1 Pre-fitting examinations of contact lens.
- 2 Fitting philosophies of soft spherical lens.
- 3 Fitting philosophies of soft toric lens.
- 4 Fitting philosophies of RGP lens.
- 5 Fitting cosmetic and prosthetic contact lenses.
- 6 Fitting Rose-k contact lens.
- 7 Fitting scleral contact lens.
- 8 Fitting aphakic contact lens.
- 9 Fitting Bifocal contact lens.

## OCULAR DISEASES AND OCULAR PHARMACOLOGY – OPH16210

UNIT	CONTENT
1	<b>Eyelids &amp; Lacrimal System Disorder:</b> Eyelid anatomy; Congenital and developmental anomalies; Blepharospasm; Ectropion; Entropion; Trichiasis and symblepharon; Eyelid inflammations; Eyelid tumours; Ptosis; Eyelid retraction; Eyelid trauma; Lacrimal anatomy; Lacrimal pump; Methods of lacrimal evaluation; Congenital and development anomalies of the lacrimal system; Lacrimal obstruction; Lacrimal sac tumours; Lacrimal trauma.
2	<b>Sclera and Episclera &amp; Orbit Disorder:</b> Ectasis, staphyloma, Scleritis and episcleritis; Orbital anatomy, Incidence of orbital abnormalities; Methods of orbital examination; Congenital and developmental anomalies of the orbit; Orbital tumours; Orbital inflammation; Sinus disorders affecting the orbit; Orbital trauma.
3	<b>Conjunctiva and Corneal Disorder:</b> Inflammation; Therapeutic principles; Specific inflammatory diseases; Tumours - Tumours of epithelial origin; Glandular and adenexa tumours; Tumours of neuroectodermal origin; Vascular Tumours; Xanthomatous origin; Inflammatory tumours; Metastatic lesions; Degeneration and dystrophies - Definition, Degeneration's, Dystrophies; Miscellaneous conditions – Kerato-conjunctivitis Sicca (K-Sicca), Tear function tests, Steven Johnson syndrome, Ocular Rosacea, Atopic eye disorders, Benign mucosal pemphigoid (BMP)-ocular pemphigoid, Vitamin A deficiency, Metabolic diseases associated with corneal changes.

4	<b>IRIS, Ciliary Body, Pupil &amp; Choroid Disorder:</b> Congenital anomalies; Primary and secondary disease of the iris and ciliary body, Tumours, Anomalies of capillary reaction; Congenital anomalies of the choroid; Diseases of the choroid; Tumours.
5	<b>Vitreous Disorder:</b> Developmental abnormalities; Hereditary hyaloidoretinopathies – Juvenile retinoschisis, Asteroid hyalosis, Cholestorolosis; Vitreous haemorrhage - Blunt trauma and vitreous, Inflammation and vitreous, Parasitic infestations, Pigment granules in the vitreous; Vitreous complications in cataract surgery.
6	<b>Retinal Vascular Anomalies:</b> Diseases of the choroidal vasculature, Bruch's membrane, and retinal pigment epithelium (RPE); Retinal tumours and retinoblastoma; Other retinal disorders – Retinal inflammations; Metabolic diseases affecting the retina; Miscellaneous disorders; Electromagnetic radiation effects on the retina; Retinal physiology and psychophysics; Hereditary macular disorders (including albinism); Peripheral retinal degeneration; Retinal holes and detachments; Intraocular foreign bodies; Photocoagulation.
7	<b>Lens Anomalies:</b> Anatomy and pathophysiology – Normal anatomy and aging process; Developmental defects; Acquired lenticular defects; Management of lenticular defects.
8	<b>Glaucoma:</b> Applied anatomy and physiology of anterior segment; Clinical Examination; Definitions and classification of glaucoma; Pathogenesis of glaucomatous ocular damage; Congenital glaucoma; Primary open angle glaucoma; Ocular hypertension; Normal Tension Glaucoma; Primary angle closure glaucoma (Primary angle closure suspect, Intermittent glaucoma, acute congestive, chronic angle closure); Secondary Glaucoma; Management: common medications, laser intervention and surgical techniques.
9	<b>Major Eye Diseases &amp; Operative Procedure:</b> Cataract; Glaucoma; Retinal detachment; Cornea ulcer & opacities; Visual loss – ophthalmic lesion; Diabetic Retinopathy; Macular degeneration; Chemical burns.
10	<b>Trauma &amp; Blindness:</b> Anterior segment trauma; Posterior segment trauma; Blindness definitions; Causes; Social implications; Rationale therapy; Drug induced ocular disease.
11	<b>Ocular Pharmacology:</b> Drug Handling by cells and Tissues; Pharmacokinetics, and Pharmacodynamics – specific to ocular surface and intraocular conditions.
12	<b>Pharmacokinetics &amp; Pharmacodynamics:</b> Drug absorption, distribution, metabolism and excretion; effect of drug and the relationship between drug concentration and response; Drug– Receptor interactions.
13	<b>Delivery Methods of Ocular Medication &amp; Tear Film Reconstitution:</b> Residence in the Conjunctival sac, drug vehicles affects drug delivery, advanced ocular delivery systems; Tear Substitutes.
14	<b>Ocular Drugs for Autonomic Nervous System and Immuno-modulators:</b> Parasympathetic (anti-muscarinic) and Sympathetic; Eicosanoids- prostaglandins, thromboxanes and leukotrienes; Glucocorticoids, Immunosuppressive agents.
15	<b>Other Ocular Drugs:</b> Local Anesthetics; Ocular Toxicity from systemic administration of Drugs.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Jimmy D. Bartlett, Siret D. Jannus, “Clinical Ocular Pharmacology”.
- B. Louis E Probst, Julie H. Tsai, “Ophthalmology, Clinical and Surgical Principles” SLACK incorporated.
- C. William B. Trattler, Peter K. Kaiser, Neil J. Friedman, “Review of Ophthalmology”.

**WEB LINKS:**

- A. <http://emedicine.medscape.com/article/1228246-overview>.
- B. [http://www.merckmanuals.com/professional/eye\\_disorders/orbital\\_diseases/tumors\\_of\\_the\\_orbit.html](http://www.merckmanuals.com/professional/eye_disorders/orbital_diseases/tumors_of_the_orbit.html).

## REFRACTIVE SURGERIES AND EYE BANKING – OPH16211

UNIT	CONTENT
1	<b>Introduction:</b> History about refractive surgery; Brief about systemic diseases and eye banking.
2	<b>Computerized Corneal Topography &amp; Wave Front Analysis:</b> Axial Power and Curvature; Instantaneous Power and Curvature; Mean Curvature; Indications For Corneal Topography In Refractive Surgery; Corneal Topography and irregular Astigmatism; Limitations of Corneal Topography; Clinical Situation illustrating the role of corneal topography in refractive Surgery; Wave Front Analysis and Irregular Astigmatism; Fermat's Principle and Wave Front Analysis; Measurement of Wave front Aberrations and Graphical Representations; Lower-Order aberrations, higher order Aberrations; Biomechanics of the Cornea; Effects of Kerato-Refractive surgery; Corneal Wound Healing; Laser Biophysics; Laser-Tissue interactions; Types of photoablating Lasers; Wave front-Guided Laser Ablation.
3	<b>Techniques Used in Refractive Surgery:</b> Flap procedures; Surface procedures; Corneal incision procedure; Other procedures.
4	<b>Expectation &amp; Risk:</b> Success about refractive surgery; Risk of refractive surgery in certain eye diseases.
5	<b>Systemic Diseases Related to Eye:</b> Arterial Hypertension & Acquired Heart Disease – Embolism: Pathophysiology, classification, clinical examination, diagnosis, complications and management; Hypertension and the eye; Rheumatic fever – pathophysiology, classification, diagnosis, complications and management. Embolism. Subacute bacterial endocarditis.
6	<b>Diabetes Mellitus:</b> Pathology, classification, clinical features, diagnosis, complications and management. Diabetes mellitus and the eye.
7	<b>Cancer – Introduction:</b> Definitions, nomenclature, characteristics of benign and malignant neoplasm. Grading of staging of cancer, diagnosis principles of treatment. Neoplasia of the eye.
8	<b>Connective Tissue Disease:</b> Anatomy and pathophysiology: Arthritis. Eye and connective tissue disease.
9	<b>Thyroid Disease:</b> Anatomy and physiology of thyroid gland, Classification of thyroid disease. Diagnosis, complications, clinical features, management, thyroid disease of the eye.
10	<b>Tuberculosis:</b> Aetiology, pathology, clinical feature, pulmonary tuberculosis, diagnosis, complications, treatment, tuberculosis and the eye.
11	<b>Helimthiasis:</b> Classification of helimenthic disease, schistosomiasis, principles of diagnosis and management. Helimenthic disease and the eye (Taenia, echinococcus, larvae migrans).
12	<b>Common Tropical Ailments (Malaria, leprosy, etc.):</b> Introduction to tropical diseases: Malaria; Tropical diseases and the eye – leprosy, toxoplasmosis, syphilis, and trachoma.
13	<b>Malnutrition:</b> Aetiology; protein energy malnutrition; water electrolytes; minerals; vitamins; nutritional disorders and the eye.
14	<b>Introduction to Immunology:</b> Components of the immune system; principle of immunity in health; Immunology in disease; Immunology and the eye.
15	<b>Neurological Disorders-Stroke/CVA:</b> Disseminated sclerosis and subacute combined degeneration; Anatomy and patho-physiology; Disseminated sclerosis, subacute combined degeneration; Eye and connective tissue disease.
16	<b>Eye Banking:</b> Introduction to Eye Banking; History & milestones; Requirements in eye bank; Duties and responsibilities of eye bank personals; indications and contra indications; Instruments; Tissue retrieval; Handling of tissue; Preservation techniques; Evaluation techniques; Specular microscopy; Documentation; Legal aspects;

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Denniston AKO, Murray PI, Handbook of Ophthalmology, Oxford (OUP), 2009.
- B. Kanski J. Clinical Ophthalmology: A Systematic Approach (7<sup>th</sup> Ed) Butterworth Heinemann (2011).
- C. Jackson TL; Moorfields, Manual of Ophthalmology, Mosby (2008).

**WEB LINKS:**

- A. <http://www.fda.gov/cdrh/lasik/>
- B. <http://www.lasikinstitute.org/>
- C. <http://www.ladarvision.com/>

## OPHTHALMIC, OPTOMETRIC AND OPTICAL INSTRUMENTS – OPH16212

UNIT	CONTENT
1	<b>The Eye:</b> General description with named parts and optical data; schematic eye- Emmetropia and Ametropia; Correction of myopia and hypermetropia; working model of human eye; resolving power of eye; visual acuity limits; tests and theoretical explanations.
2	<b>Reflection and Refraction:</b> Experiments illustrating reflection at single, double and multiple mirrors; Principles of periscope; Binocular prism; Root edge reflection; Pentagonal prism, Tetrahedron concave and convex minor; Laws of refraction; Critical angle and internal reflection; Action of lenses- ray tracing methods, graphical and trigonometrical.
3	<b>Focal Length Measurements:</b> Optical bench; Local lengths of ‘thin’ positive and negative lenses; two thin lenses in contact, two thin lenses separated; Newton's method; Local length of ‘thick’ lenses; magnification method; Foco-coillimator; Nodal slide method.
4	<b>Binocular Vision:</b> Introduction; Field of view and eye movements; Binocular summation; advantages of a Binocular vision; Binocular interaction; Sensory Aspects of Binocular vision; Binocular rivalry; Utrocular discrimination; development of binocular vision; eye dominance; grades of binocular vision; investigations for binocular vision; Stereopsis; Disorders.
5	<b>The Telescope:</b> Model telescopes, astronomical and Galilean types measurement of magnifies view and angular field of view; Entrance and exit pupils; Models of Huygenian; Ramsden and sour-lens terrestrial eyepiece; Types of object glass and eyepieces used commercially; Tests on telescopes for definition; Squaring-on, strain, stray light, resolving power; Necessary power of eyepiece; Binocular telescopic Instruments; Angular accommodation; Apparatus for adjusting binocular telescopes; Wide field of view sighting telescopes; Variable power telescopes.
6	<b>The Microscope:</b> Hand magnifiers; Compound microscope; Optical bench models and Modern instruments; Correct setting up of the microscope; Numerical aperture; Pertometers; Resolving power, Necessary magnification to employ; Photo-micrography; Opaque objects; Ultra-violet microscopy at various wavelengths; Reflection microscopes; Electron microscope.
7	<b>Photographic Lenses:</b> Aberrations; Principles for reducing coma and astigmatism; Optical bench models illustrating definition performance for meniscus, symmetrical and anastigmatic types of photographic lenses; Theory with numerical examples illustrating

	the advantages of various types of glass; Measurement of astigmatic fields; Telephoto lenses; Complete tests on photographic lenses; Resolving power; Depth of focus, image space and object space; Schmidt camera.
8	<b>Optical Projection Systems &amp; Optical glass:</b> Measurement of solid angle; Intrinsic brightness, transmission factors, intensity of illumination on projection screens; Sources of light for projection purposes; Projection of transparencies; Loss of light in projection systems; Projection of opaque objects; Searchlights, signaling lamps, head lights; Projection in engineering practice; Physical experiments; Micro-Projection; Lighthouse projection systems, marine lanterns, railway signal lamps.
9	<b>Optical Glass:</b> Advantages of a variety in optical glasses; Production of optical glass; Annealing; Strain; Homogeneity; Optical constants; Refractometry; Glass working-principles of grinding and polishing processes, abrasives, edging; radius of curvature measurements; Mechanical and optical; Test plates, flat and curved; Methods of producing test plates; Angle measurement, goniometer, auto-collimator, naked eye tests; Non-reflecting films on glass.
10	<b>Operation and Application of Ophthalmic, Optical and Optometric Instruments:</b> Spectrometer; Radiuscope; Retinoscopes; Standard Tests Charts; Auto refractometer-subjective and objective types; Ophthalmoscopes- direct and indirect types; Refractometers - Auto refractors, Dioptron; Slit lamp Biomicroscope; Keratometer; Lensometer; Trial case lenses-best forms; Trial frame design; Cross cylinder. Focimeter or Lensometer; Retinoscope; Standard Test Charts; Auto refractometer; Slit Lamp Examination; Keratometer; Ophthalmoscope; Tonometer – Principles, types, clinical importance as a routine procedure (application); Pachymeter – Principles, types, clinical importance; Devices for color vision testing – CS testing / Glare testing; Ultrasonography – (A scan, B scan) – Principles and application; F.F.A – Principles and demonstration of film; PAM – Principles and importance; Perimeter – Basics of perimetry – Humphray instruments, Automated perimetry – basics, types (names), interpretation of normal Glaucoma Field of Definition; LASER – Introduction – Einstein co-efficient, population inversion; Different types of LASER (mention) – Excimer, Lasik Nd-yag, Argon, Diode, He-Ne gas LASER, Xenon; LASER safety, Ophthalmic LASER application (Argon, Yag).

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Mohindra I, Held R, Gwiazda J, Brill S. Astigmatism in infants. Science. 1978; 202: 329-31.
- B. Collins MJ, Brown B, Bowman KJ. Peripheral visual acuity and age. Ophthalmic Physiol Opt. 1989; 9: 314-6.
- C. Ridley H. Intraocular acrylic lenses. A recent development in the surgery of cataract. Br. J. Ophthalmol. 1952; 36:113-22

**WEB LINKS:**

- A. <http://vision.about.com/od/basicvision/g/Emmetropia.htm>.
- B. <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002018/>
- C. <http://www.webmd.com/eye-health/tc/nearsightedness-myopia-topic-overview>.

**OPHTHALMIC, OPTOMETRIC AND OPTICAL INSTRUMENTS (P) –**  
**OPH16212P**

- 1 Retinoscopy.
- 2 Use of Radiuscope.

- 3 Ophthalmoscopy.
- 4 Lensometry.
- 5 Slit lamp biomicroscopy.
- 6 Use of Jackson Cross Cylinder.
- 7 Keratometry.
- 8 Tonometry.
- 9 Pachymetry.

## MEDICAL INFORMATICS – MIN16201

UNIT	CONTENT
1	<b>Overview of Medical Informatics:</b> Introduction, definition of medical informatics; Aspects of medical informatics - clinical care, health service administration, research, patient and provider education; Structure of Medical Informatics –Internet and Medicine; Security issues; Computer based medical information retrieval; Hospital management and information system; Functional capabilities of a computerized HIS; e-health services; Health Informatics – Medical Informatics, Bioinformatics.
2	<b>Computerized Patient Record:</b> Introduction - History taking by computer; Dialogue with the computer; Components and functionality of CPR; Development tools; Intranet; CPR in Radiology - Application server provider; Clinical information system; Computerized prescriptions for patients.
3	<b>Computers in Clinical Laboratory and Medical Imaging:</b> Automated clinical laboratories-Automated methods in hematology, cytology and histology; Intelligent Laboratory Information System - Computerized ECG, EEG and EMG; Computer assisted medical imaging- nuclear medicine; Ultrasound imaging ultrasonography-computed X-ray tomography; Radiation therapy and planning; Nuclear Magnetic Resonance.
4	<b>Computer Assisted Medical Decision-Making:</b> Neuro computers and Artificial Neural Networks application; Expert system – General model of CMD; Computer –assisted decision support system-production rule system cognitive model, semester networks, decisions analysis in clinical medicine; Computers in the care of critically patient; Computer assisted surgery-designing.
5	<b>Biomedical Records, Data and Images:</b> Electronic Medical Record (EMR) environments; Laboratory data, anatomic data; Biomedical imaging; PACS systems; DICOM images; PDB (Protein Data Bank); European Bioinformatics Institute (EBI) services.
6	<b>Biomedical Modeling and Simulation:</b> Physiological models; Virtual Physiological Human; Geometric models of proteins, cells, tissues and systems; Geometric models of neurons, axons and dendrites; Models of the neuro-muscular interface.
7	<b>Recent Trends in Medical Informatics:</b> Virtual reality applications in medicine; Computer assisted surgery; Surgical simulation; Telemedicine - Tele surgery computer aids for the handicapped; Computer assisted instrumentation in Medical Informatics; Computer assisted patient education and health; Medical education and health care information.
8	<b>e-Health Trends and Technologies:</b> The Impact of the Internet on Health Care Providers and Patients; Defining eHealth; Internet Computer Standards; eHealth's Emerging Sectors; The Impact of Informatics on the Socio cultural Environment of Health Care; The Implications of Information Technology for Research; Locating Research Information; The Internet and Health-Related Research; Analysis of Research Data; Statistical Packages; Electronic Dissemination of Research Results-Sharing Results with Others; Use of the Intent for Research; Pro and Con; Ethics of Online Research; Sources of information; Support and Organizations for Informatics Research.



9	<b>Current Research in Health Care Informatics:</b> The Impact of Health Care; Informatics on the Organization; Relevance of Theories about Organizations to Health Care Informatics; Open Systems Theory; Information Needs and Challenges in Today's Health Care Environment; Informatics; Virtual Organizations; Advances in Health Care Informatics in the Clinical Area; Smart Phone/Patient Self-Scheduling; Changes in Professional Practice Due to Advances in Health Care Informatics; Changes in Management Roles Due to Advances in Health Care Informatics.
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**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Richard S. Dick. The Computer Based Patient Record: An Essential Technology for Health Care.
- B. Elaine B. Steen, and Don E. Detmer, Editors; Committee on Improving the Patient Record, (1997).
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