## BHARATHIAR UNIVERSITY, COIMBATORE-641 046

### B.Sc. Optometry (4 Years Degree Course with One year Compulsory Internship)
(For the CPOP students admitted during the academic year 2010-11 & onwards)

#### SCHEME OF EXAMINATION – CBCS Pattern

<table>
<thead>
<tr>
<th>Part</th>
<th>Course Title</th>
<th>Ins. hrs / week</th>
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| TOTAL | 4550 | 182 |

@ No University Examinations. Only Continuous Internal Assessment (CIA)
# No Continuous Internal Assessment (CIA). Only University Examinations.
* Project Report : 80% and Viva-Voce Examinations: 20%.

### List of Elective Papers (Colleges can choose any one of the paper as Electives)

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<thead>
<tr>
<th>Elective – I</th>
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<tbody>
<tr>
<td>A</td>
<td>Nutrition</td>
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<td>B</td>
<td>Low &amp; Optometry</td>
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<td>C</td>
<td>Clinical Psychology</td>
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<td>A</td>
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<tr>
<td>B</td>
<td>Operation Theatre Techniques</td>
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<td>C</td>
<td>Nursing Procedure</td>
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### List of Special Clinic for Internship (Candidate can choose any one of special clinic)

1. Contact Lens Clinic
2. General Ophthalmology Clinic
3. Glaucoma Clinic
4. Ophthalmic Ultra Sound Clinic
5. Low Vision Aid Clinic
6. Ophthalmic Imaging Clinic
7. Refractive Surgery Clinic
8. Retina Clinic
9. Cornea Clinic
10. Paediatric Ophthalmology
11. Squint Clinic
12. Oculoplasty Clinic

**Note:** The Total Marks and total credits are corrected as 4550 and 182 instead of 4500 and 180. There is no classification for Part VI (on par with Part IV and V in the UG Regulations).

However, these parts shall be awarded with grades and marks in the statement of marks and in the consolidated statement of marks.
SEMESTER 1

CORE PAPER I - GENERAL ANATOMY & PHYSIOLOGY

**Course Description:** General anatomy deals with the entire human anatomy with emphasis on different tissues, blood vessels, glands, nerves and the entire central nervous system in particular. General physiology deals with the entire human anatomy with emphasis on different organ systems, their physiological functions with special emphasis on blood and neuro physiology.

**Objectives:** At the end of the course, the student should be able to:

- Comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the human body.
- Comprehend the basic structure and connections between the various parts of the central nervous system so as to analyze the integrative and regulative functions on the organs and systems.
- Explain the normal functioning of various organ systems of the body and their interactions.
- Know the physiological principles underlying pathogenesis of disease

**Unit: I**

**General Anatomy:**
Introduction to Human Anatomy:_Anatomy: Definition and its relevance in medicine and optometry - Planes of the body, relationship of structures, organ system, Skeleton System

**Tissues of the Body:**
Epithelium, connective tissue, bone and cartilage, Embryology, histology, different types of each of them, types of cells, cellular differentiation and arrangements in different tissues

**Muscles:**
Different types of muscles, their functional differentiation, their relationship with different structures, and their neural supply

**Blood vessels:**
Differentiation between arteries and veins, embryology, histology of both arteries and veins, Functional differences between the two, anatomical differences at different locations

**Unit: II**

**Skin and appendages:**
Embryology, anatomical differences in different areas, functional and protective variations, innervations, relationship with muscles and nerves

**Lymphatic system:**
Embryology, functions, relationship with blood vessels and organs

**Glands:**
Embryology, different types of glands (exocrine and endocrine), functional differences, neural control of glands
Nervous system:
Parts of Nervous system, cell types of nervous system, Blood-brain barrier, Reflex arc, Peripheral Nerves, Spinal nerves, Nerve fibers, Autonomic Nervous system

Brain and Cranial nerves:
Major parts of Brain, Protective coverings of the Brain, Cerebrospinal Fluid, Brain stem, Cerebellum, Diencephalon, Cerebrum, Cranial nerves

Unit: III
General Physiology
Cell structure & organization, Tissue organization, Epithelium
Connective tissue – Collagen fibers – Elastic fibers – Areolar fibers
Cartilage – Bone, Contractile tissue – striated – skeletal – cardiac – non striated – plain – myoepithelial - General principles of cell physiology, Physiology of skeletal muscle

BLOOD:
Composition, Volume measurement & variations, Plasma proteins – classification & functions
Red blood cells – development, morphology & measurements – functions & dysfunctions.
White blood cells – development – classification, morphology – functions & dysfunctions

DIGESTION:
General arrangement : Salivary digestion – functions & regulations, Gastric digestion – functions & regulations, Pancreatic digestion – functions & regulations, Intestinal digestion – functions & regulations, Liver & bile, Absorption, Motility, Deglutition, Vomiting, Defecation, Functions of large intestine, Neurohumoral regulations of alimentary functions, summary

Unit: IV
EXCRETION:

ENDOCRINES:
Hormone mechanism – negative feed backs – tropic action – permissive action – cellular action, hypothalamic regulation
Thyroid – hormones, actions, regulations
Adrenal cortex – hormones, actions, regulations
Adrenal medulla – hormones, actions, regulations
Parathyroid – hormones, actions, regulations
Islets of pancreas – hormones, actions, regulations
Miscellaneous – hormones, actions, regulations
Common clinical disorders
Unit: V

REPRODUCTION:

Respiration:

Circulation:
General principles

Nervous System:

Texts Books:

Reference Books:
SEMESTER I

CORE PAPER II – PHYSICAL OPTICS

Course Description: This course will be taught in one semester. Physical Optics is the study of light, its properties and its interaction with matter. Specifically, the phenomena of interference, diffraction, polarization and scattering will be dealt with in detail.

Objectives: The objective of this course is to equip the students with a thorough knowledge of properties of light. At the end of this course, students will be able to predict the distribution of light under various conditions.

Unit: I
Nature of light – light as electromagnetic oscillation – wave equation; ideas of sinusoidal oscillations – simple harmonic oscillation; transverse nature of oscillation; concepts of frequency, wavelength, amplitude and phase.
Sources of light; Electromagnetic Spectrum.

Unit: II
Polarized light; linearly polarized light; and circularly polarized light.
Intensity of polarized light; Malus’ Law; polarizers and analyzers; Methods of producing polarized light; Brewster’s angle., Birefringence; ordinary and extraordinary rays.
Relationship between amplitude and intensity. Coherence; interference; constructive interference, destructive interference; fringes; fringe width

Unit: III
Double slits, multiple slits, gratings.
Diffraction; diffraction by a circular aperture; Airy’s disc

Unit: IV
Resolution of an instrument (telescope, for example); Raleigh’s criterion
Scattering; Raleigh’s scattering; Tyndall effect.
Fluorescence and Phosphorescence

Unit: V
Basics of Lasers – coherence; population inversion; spontaneous emission; Einstein’s theory of lasers.
Radiometry; solid angle; radiometric units; photopic and scotopic luminous efficiency and efficacy curves; photometric units
Inverse square law of photometry; Lambert’s law.
Other units of light measurement; retinal illumination; Trolands

**Text Book:**

**Reference Books:**

**SEMESTER I**

**ALLIED PAPER I – BIOCHEMISTRY**

**Course Description:** This course deals with the biochemical nature of carbohydrates, proteins, minerals, vitamins, lipids etc. A detailed study of these, emphasizing on their chemical composition and their role in metabolism is the required aim of this course.

**Objectives:** At the end of the course, the student should be able to: demonstrate his knowledge and understanding on
- Structure, function and interrelationship of biomolecules and consequences of deviation from normal.
- Integration of the various aspects of metabolism, and their regulatory pathways.
- Principles of various conventional and specialized laboratory investigations and instrumentation, analysis and interpretation of a given data.

**Unit: I**
**Carbohydrates:**
Glucose; fructose; galactose; lactose; sucrose; starch and glycogen (properties and tests, Structure and function)

**Proteins:**
Amino acids, peptides, and proteins (general properties & tests with a few examples like glycine, tryptophan, glutathione, albumin, hemoglobin, collagen)

**Unit: II**
**Lipids:**
Fatty acids, saturated and unsaturated, cholesterol and triacylglycerol, phospholipids and plasma membrane

**Vitamins:**
General with emphasis on A,B2, C, E and inositol (requirements, assimilation and properties)

**Unit: III**
**Minerals:**
Na, K, Ca, P, Fe, Cu and Se.(requirements, availability and properties)
Hormones and their receptors basic concepts in metabolic regulation with examples, insulin, glucagons and thyroxine

**Unit: IV**
Metabolism: General whole body metabolism (carbohydrates, proteins, lipids)

**Unit: V**
Ocular Biochemistry
Various aspects of the eye, viz. tears, cornea, lens, aqueous, vitreous, retina and pigment epithelium rhodopsin. (The important chemicals in each and their roles).
Clinical Biochemistry
Blood sugar, urea, creatinine and Bilirubin, cholesterol etc and significance of their estimation.

**Text book**:
1. Ramakrishnan: Essentials of biochemistry and ocular biochemistry, Annamalai University Publications, Chidambaram, India, 1992

**Reference Books**:

**SEMESTER II**

**CORE PAPER III – OCULAR ANATOMY & PHYSIOLOGY**

**Course Description**: This course deals with detailed anatomy of the orbit, eyeball and cranial nerves associated with ocular functions. Ocular physiology deals with the physiological functions of each part of the eye.

**Course Objectives**: At the end of the course, the student should be able to:
- Comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the eye and adnexa and and understand the basic principles of ocular embryology
- Comprehend the basic structure and connections between the various parts of the central nervous system and the eye so as to understand the neural connections and distribution.
- Elucidate the physiological aspects of normal growth and development of the eye.
- List the physiological principles underlying pathogenesis and treatment of disease of the eye.

**Unit: I**
Anatomy:
Cornea: Anatomy of all the layers, cellular structure, nerve supply, reason for transparency, refractive properties
Coats of eyeball:
Sclera (episclera & sclera), Choroid (Iris, ciliary body, choroid), Retina

Detailed anatomy, cellular structure, vasculature, nerve supply for all the above coats, pupils, nerve supply for pupillary actions, pupillary pathway. Crystalline lens, Aqueous, anterior chamber, vitreous body

**Unit: II**
Ocular Embryology
Detailed study of orbit
Ocular Adnexa and Lacrimal system
Extra ocular muscles (anatomy, innervations, action)
Orbital Blood supply

**Unit: III**
CRANIAL NERVES:
Detailed study of each of the following nerves in terms of their nucluei, course, relationship within brain, effects of compression etc at different regions
Optic nerve
Oculomotor nerve
Trochlear nerve
Trigeminal nerve
Abducent nerve
Facial nerve
Visual Pathway, Autonomic Innervations of Ocular structures

**Unit: IV**
Physiology:
Protective mechanisms in the eye
Precorneal tear film, eyelids and lacrimation
Extrinsic Ocular muscles, their actions and control of their movements
Saccadic, smooth pursuit and Nystagmic eye movements
Coats of the eye ball
Corneal Physiology
Aqueous humor and vitreous: Intra ocular pressure
Iris and pupil

**Unit: V**
Crystalline lens and accommodation – presbyopia
Retina – structure and functions, dark and Light Adaptations
Vision – general aspects of sensation

Pigments of the eye and photochemistry, electrophysiology
The visual stimulus, refractive errors
Visual acuity, vernier acuity and principle of measurement
Visual perception – Binocular vision, stereoscopic vision, optical illusions
Visual pathway, central and cerebral connections, lesions of pathway and effects
Colour vision and colour defects. Theories and diagnostic tests

Text Book:

Reference Books:
2. RD Ravindran: Physiology of the eye, Arvind eye hospitals, Pondicherry, 2001

SEMESTER II

CORE PAPER IV – GEOMETRIC OPTICS

Course Description: Geometric Optics is the study of light and its behavior as it propagates in a variety of media. Specifically, the phenomena of reflection and refraction of light at boundaries between media and subsequent image formation will be dealt with in detail. Reflections at plane and spherical surfaces and refractions at plane, spherical, cylindrical and toric surfaces will be studied in this course. Attention will be given to the system of surfaces and/or lenses and their imaging properties. The effect of aperture stops on the quality of images, such as blur and aberrations, depth of field and depth of focus, will also be studied.

Objectives: The objective of this course is to equip the students with a thorough knowledge of mirrors and lenses. At the end of this course, students will be able to predict the basic properties of the images formed on the retina by the optics of the eye.

Unit: I
Nature of light – light as electromagnetic oscillation; ideas of sinusoidal oscillations; amplitude and phase; speed of light in vacuum and other media; refractive index
Wavefronts – spherical, elliptical and plane; Curvature and vergence; rays; convergence and divergence in terms of rays and vergence; vergence at a distanceRefractive index; its dependence on wavelengthFermat’s and Huygen’s Principle – Derivation of laws of reflection and refraction (Snell’s law) from these principlesPlane mirrors – height of the mirror; rotation of the mirrorReflection by a spherical mirror – paraxial approximation; sign convention; derivation of vergence equation
Imaging by concave mirror, Imaging by convex mirror, Reflectivity; transmittivity, Snell’s Law; refraction at a plane surface
Glass slab; displacement without deviation; displacement without dispersion
Thic prisms; angle of prism; deviation produced by a prism; refractive index of the prism
Unit: II
Prisms; angular dispersion; dispersive power; Abbe’s number.
Definition of crown and flint glasses; materials of high refractive index
Thin prism – definition; definition of Prism diopter; deviation produced by a thin prism; it
dependence on refractive index
Refraction by a spherical surface; sign convention; introduction to spherical aberration using
image formed by a spherical surface of a distance object; sag formula
Paraxial approximation; derivation of vergence equation
Imaging by a positive powered surface, Imaging by a negative powered surface
Vergence at a distance formula; effectivity of a refracting surface
Definition of a lens as a combination of two surfaces; different types of lens shapes.
Image formation by a lens by application of vergence at a distance formula; definitions of front
and back vertex powers; equivalent power; first and second principal planes/points; primary and
secondary focal planes/points; primary and secondary focal lengths

Unit: III
Newton’s formula; linear magnification; angular magnification
Nodal Planes, Thin lens as a special case of thick lens; review of sign convention
Imaging by a thin convex lens; image properties (real/virtual; erect/inverted; magnified/minified)
for various object positions
Imaging by a thin concave lens; image properties (real/virtual; erect/inverted;
magnified/minified) for various object positions
Prentice’s Rule
System of two thin lenses; review of front and back vertex powers and equivalent power, review
of six cardinal points., System of more than two thin lenses; calculation of equivalent power
using magnification formula

Cylindrical Lenses; image formation; relation between cylinder axis and line image orientation
Imaging due to two cylinders in contact with axes parallel
Two cylinders in contact with axes perpendicular; line images and their orientations to the
cylinders’ powers; interval of Sturm; circle of least confusion (CLC); spherical equivalent;
position of CLC
Spherical lens and a cylindrical lens in contact; spherical equivalent; interval of Sturm and CLC
Spherocylindrical lens notations – plus/minus cylinder form, cross cylinder/meridian form;
transformations between them

Unit: IV
Field stops and apertures; entrance and exit pupils
Apertures and defocus blur
Receiver/detector diameter; depth of focus; depth of field
Chromatic Aberrations; methods of removing chromatic aberrations; Abbe number
Monochromatic Aberrations – deviation from paraxial approximation; difference between ray aberrations and wavefront aberrations

Third order aberrations – spherical aberrations; coma; astigmatism; distortion and curvature of fields

Ways of minimizing spherical aberrations – pupil size, bending of lens, shape factor

Lens tilt – astigmatism

Higher order aberrations; introduction to Zernike Polynomials

**Unit: V**

Telescopes – Keplerian, Galilean and Newtonian; position of cardinal points, entrance and exit pupils; magnifications; advantages and disadvantages

Microscopes – magnification; tube length.

Gullstrand’s Schematic Eye (GSE); calculation of the power of the cornea, the lens and the eye; axial length; calculation of the position of the cardinal points; magnification

GSE - Purkinje images and their reflectances

GSE - entrance and exit pupils for a 3mm pupil; ocular aberrations – spherical aberrations and coma; chromatic aberrations.

GSE – introduction to refractive errors - myopia and hyperopia; corneal curvature; axial length; far point; blur size calculations; corrections; astigmatism; blur size; circle of least confusion; correction.

GSE - Object closer than at infinity; introduction to accommodation; far point; near point; presbyopia; spectacle and contact Lens corrections - comparison of magnification

**Text book:**


**Reference Books:**

SEMESTER II
ALLIED PAPER II – MICROBIOLOGY

Course Description: This course covers the basic biological, biochemical and pathogenic characteristics of pathogenic organisms.

Course Objectives: The objectives of the course are:

- to prepare the students to gain essential knowledge about the characteristics of bacteria, viruses, fungi and parasites;
- to acquire knowledge of the principles of sterilization and disinfection in hospital and ophthalmic practice;
- to understand the pathogenesis of the diseases caused by the organisms in the human body with particular reference to the eye infections and to understand basic principles of diagnostic ocular Microbiology

Unit: I
Introduction to Microbiology
Types of Microorganisms
Physiology of Microorganisms – Nutrition, Enzymes, Metabolism and energy, Microbial Growth
Sterilization and disinfection in the laboratory

Unit: II
Control of Microbial Growth – Antimicrobial methods and Chemotherapy
Microbes versus Humans- The development of Infection, the disease process, pathogenicity and virulence - Ocular Bacteriology - Gram positive,(Staphylococcus aureus, Staphlococcus epidermidis, Streptococcus, propionibacterium, actinomyces,Nocardia) Bacteria including acid fast bacilli ( Myobacterium tuberculosis, Myobacterium leprae)

Unit: III
Ocular Bacteriology - Gram negative Bacteria (pseudomonas, haemophiilus, Brucella, Neisseria, Moraxella) Spirochetes (Treponema, Leptospirocraceae)

Unit: V
Virology: Classification of Viruses in Ocular Disease, Rubella, Adenovirus, Oncogenic Viruses (HPV, HBV, EBV, Retroviruses), HIV.
Fungi : Yeasts, Filamentous, Dimorphic - Intracellular parasites - Chlamydia, Protozoa (Taxoplasmosis, Acanthamoeba,) Helminths ( Toxocariasis, Filariasis, Onchocerciasis, Trematodes)

Text books:
2. M J Pelczar (Jr),ECS Chan, NR Krieg : Microbiology ,fifth edition, TATA McGRAW-HILL Publisher, New Delhi,1993
**Reference Books:**

1. KJ Ryan, CG Ray: Sherris Medical Microbiology- An Introduction to infectious Diseases, fourth edition, McGRAW HiLL Publisher, NewDelhi, 1994
2. MACKIE & McCartney Practical Medical Microbiology, SYDNEY M. FINEGOLD & ELLEN JO BARON: Diagnostic Microbiology (DM)

**SEMESTER II**

**CORE PRACTICAL I – GEOMETRIC & PHYSICAL OPTICS**

(Examination at the end of second semester)

1. Gratings – determination of grating constant using Sodium vapour lamp; determination of wavelengths of light from Mercury vapour lamp
2. Circular Apertures – measurements of Airy’s disc for apertures of various sizes
3. Verification of Malus’ Law using a polarizer – analyzer combination
4. Demonstration of birefringence using Calcite crystals
5. Measurement of the resolving power of telescopes.
6. Newton’s rings
7. Demonstration of fluorescence and phosphorescence using crystals and paints
8. Thick Prism – determination of prism angle and dispersive power; calculation of the refractive index
9. Thin Prism – measurement of deviation; calculation of the prism diopter
10. Image formation by spherical mirrors
11. Convex lens - power determination using lens gauge, power determination using distant object method; power determination using the vergence formula
13. Construction of a tabletop telescope – all three types of telescopes.
14. Construction of a tabletop microscope
15. Imaging by a cylindrical lens – relationship between cylinder axis and image orientation
16. Imaging by two cylinders in contact – determination of the position of CLC; verification of CLC using a spherical lens with power equal to the spherical equivalent; orientations and position of the line images and their relation to the cylinders’ powers and orientations
17. Imaging by a spherocylindrical lens – sphere and cylinder in contact – determination of the position of CLC; verification of CLC using a spherical lens with power equal to the spherical equivalent; orientations and position of the line images and their relation to the cylinder’s power and orientation
SEMESTER III

CORE PAPER V – OPTOMETRIC OPTICS

Course Description: This course deals with understanding the theory behind spectacle lenses and frames, their materials, types, advantages and disadvantages, calculations involved, when and how to prescribe. It will impart construction, design application and development of lenses, particularly of the methods of calculating their power and effect.

Course Objectives: Skills/knowledge to be acquired at the end of this course:

- Measurement of lens power, lens centration using conventional techniques
- Transposition of various types of lenses
- Knowledge to identify different forms of lenses (equi-convex, planoconvex, periscopic, etc.)
- Knowledge to select the tool power for grinding process.
- Measurement of surface powers using lens measure.
- Method of laying off the lens for glazing process.
- Ophthalmic prism knowledge – effects, units, base-apex notation, compounding and resolving prisms.
- Knowledge of prism and decentration in ophthalmic lenses
- Knowledge of different types of materials used to make lenses and its characteristics
- Knowledge lens designs – single vision, bifocals, progressive lens
- Knowledge on tinted and protective lenses
- Knowledge on special lenses like iseikonic, spectacle magnifiers.
- Knowledge on spectacle frames – manufacture, materials

Unit: I
Introduction – Light, Mirror, Reflection, Refraction and Absorption
Prisms – Definition, properties, Refraction through prisms, Thickness difference, Base-apex notation, uses, nomenclature and units, Sign Conventions, Fresnel’s prisms, rotary prims
Lenses – Definition, units, terminology used to describe, form of lenses
Vertex distance and vertex power, Effectivity calculations
Lens shape, size and types i.e. spherical, cylindrical and Sphero-cylindrical
Transpositions – Simple, Toric and Spherical equivalent
Prismatic effect, centration, decentration and Prentice rule, Prismatic effect of Plano-cylinder and Sphero-cylinder lenses
Spherometer & Sag formula, Edge thickness calculations
Magnification in high plus lenses, Minification in high minus lenses
Tilt induced power in spectacles
Aberration in Ophthalmic Lenses
Unit: II
Raw materials – History and General Outline, Manufacturing of Ophthalmic Blanks – Glass & Plastics, Terminology used in Lens Workshops, Surfacing process from Blanks to lenses
Definition & Materials (Glass, Plastics, Polycarbonate, Triology) types and Characteristics
Properties (Refractive index, specific gravity, UV cut off, impact resistance – include drop ball test, abbe value, Center thickness)

Unit: III
Best form of lenses & Safety standards for Ophthalmic lenses (FDA, ANSI, ISI, Others)
Design of High Powered Lenses - Hi-index lenses, Calculation of Refractive index
Bifocal designs, their manufacturing & uses (Kryptok, Univis D, Executive, Invisible, Occupational) Progressive Addition Lenses, modified near vision lenses (designs, advantages, limitations)

Unit: IV
Lens enhancements (Scratch resistant coatings – spin/dip, Anti-reflection coating, UV coating, Hydrophobic coating, anti-static coating
Lens defects – Description and Detection
Glazing & edging (manual & automatic)
Special lenses
- Lenticulars
- Aspherics
- Fresnel lenses & Prisms
- Aniseikonic lenses
- Photochromics
- Polaroids
- Tinted lenses – Tints, filters
Project to ensure awareness on lens availability in Indian market

Unit: V
History of Spectacles, manufacturing overview, Definition, parts & measurements
Classification of frames – Materials (cover in detail), Colours and Temple position (advantages & disadvantages, where to use), Special purpose frames (sports, kids, reading)

Text Books:


Reference Books:

SEMESTER III

CORE PAPER VI – VISUAL OPTICS I

Course Description: This course deals with the concept of eye as an optical instrument and thereby covers various optical components of eye, types of refractive errors, clinical approach in diagnosis and management of various types of refractive errors.

Course Objectives: Upon completion of the course, the student should be able:

- to understand the fundamentals of optical components of the eye
- to gain theoretical knowledge and practical skill on visual acuity measurement, objective and subjective clinical refraction.

Unit: I
REVIEW OF GEOMETRICAL OPTICS
VERGENCE AND POWER:; Conjugacy, object space and image space. Sign convention
Spherical refracting surface, Spherical mirror; catoptric power, Cardinal points, Magnification
Light and visual function
Clinical Relevance of: Fluorescence, Interference, Diffraction, Polarization, Bi-refringence, Dichroism Aberration and application, Spherical and Chromatic

Unit: II
OPTICS OF OCULAR STRUCTURE
Cornea and aqueous
Crystalline lens
Vitreous
Schematic and reduced eye

Unit: III
MEASUREMENTS OF OPTICAL CONSTANTS OF THE EYE
Corneal curvature and thickness
Keratometry
3.3 Curvature of the lens and ophthalmophakometry
Axial and axis of the eye
Basic Aspects of Vision.

Unit: IV
Visual Acuity, Light and Dark Adaptation, Color Vision, Spatial and Temporal Resolution
Science of Measuring visual performance and Application to Clinical Optometry

Unit: V
REFRACTIVE ANOMALIES AND THEIR CAUSES
Etiology of refractive anomalies Contributing variability and their ranges
Populating distributions of anomalies.
Optical component measurements
Growth of the eye in relation to refractive errors
**Text books:**

**Reference Books:**
5. T Grosvenor: Primary Care Optometry, 4th edition, Butterworth Heinemann, USA, 2002

**SEMESTER III**

**CORE PAPER VII – OPTOMETRIC INSTRUMENTS & EXAMINATION OF VISUAL SYSTEM**

**Course Description:** This course covers commonly used optometric instruments, its basic principle, description and usage in clinical practice. Also it covers various clinical optometry procedures involving external examination, anterior segment and posterior segment examination, neuroophthalmic examination, pediatric optometry examination, and Glaucoma evaluation.

**Course Objectives:** Upon completion of the course, the student should be able to gain theoretical knowledge and basic practical skill in handling the Optometric & Ophthalmic instruments - And the students will be skilled in knowing the purpose, set-up and devices required for the test, indications and contraindications of the test, step-by-step procedures, documentation of the findings, and interpretation of the findings of the various clinical optometry procedures.

**Unit: I**

**REFRACTIVE INSTRUMENTS**
- Optotypes and MTF, Spatial Frequency
- Test charts standards.
- Choice of test charts
- Trial case lenses
- Refractor (phoropter) head units
- Optical considerations of refractor units
- Trial frame design
- Near vision difficulties with units and trial frames
- Retinoscope – types available
- Adjustment of Retinoscopes- special features
- Objective optometers.
Infrared optometer devices.
- Projection charts
- Illumination of the consulting room.
- Brightness acuity test
- Vision analyzer
- Pupilometer
- Potential Acuity Meter
- Abberometer

**Unit: II**

OPHTHALMOSCOPES AND RELATED DEVICES
- Design of ophthalmoscopes - illumination
- Design of ophthalmoscopes - viewing
- Ophthalmoscope disc
- Filters for ophthalmoscopy
- Indirect ophthalmoscope

**Unit: III**

Lensometer, Lens gauges or clock
- Slit Lamp, Tonometers
- Keratometer and corneal topography, Refractometer
- Orthoptic Instruments (Synoptophore Only), Color Vision Testing Devices
- Fields Of Vision And Screening Devices
- Scans, ERG, New Instruments

**Unit: IV**

Examination of Visual System
- History taking, Visual acuity estimation
- Extraocular motility, Cover test, Alternating cover test, Hirschberg test, Modified Krimsky,
- Pupils Examination, Maddox Rod, van Herrick,

**Unit: V**

External examination of the eye, Lid Eversion
- Schirmer’s, TBUT, tear meniscus level, NITBUT (keratometer),
- Color Vision, Stereopsis,
- Confrontation test, Photostress test,
- Slitlamp biomicroscopy, Direct Ophthalmoscopy,
- Digital pressure, Schiotz Tonometry, Applanation Tonometry
- Gonioscopy ROPLAS, Amsler test,
- Corneal Sensitivity, HVID
- Saccades and Pursuits

**Text books:**
Reference books:

1. **P R Yoder**: Mounting Optics in Optical Instruments, SPIE Society of Photo-Optical Instrumentation, 2002

**SEMESTER III**

**ALLIED PAPER III – PHARMACOLOGY**

**Course Description**: This course covers the actions, uses, adverse effects and mode of administration of drugs, especially related to eyes.

**Course Objective**: At the end of the course students will be knowledgeable in the following:
- basic principles of Pharmacokinetics and Pharmacodynamics
- commonly used ocular drugs, mechanism, indications, contraindications, drug dosage, and adverse effects.

**Unit: I**
Pharmacokinetics: Drug absorption, distribution, metabolism and excretion
Pharmacodynamics: Drug Handling by the body – effect of drug and the relationship between drug concentration and response, Drug – Receptor interactions

**Unit: II**
Ocular Pharmacology: Drug Handling by cells and Tissues - Pharmacokinetics, and Pharmacodynamics– specific to ocular surface and intraocular conditions

**Unit: III**
Delivery methods of Ocular Medication: Residence in the Conjunctival sac, drug vehicles affect drug delivery, advanced ocular delivery systems
Reconstituting the tear film: Tear Substitutes

**Unit: IV**
Ocular Drugs and the Autonomic Nervous system: Parasympathetic( antimuscaranics) and Sympathetic
Intraocular pressure Drugs
Eicosanoids: prostaglandins, thromboxanes and leukotrienes
Serotonin: Neurotransmitter; Glucocorticoids, Immunosuppressive agents

Unit: V
Local Anaesthetics, Ocular Toxicity from systemic administration of Drugs

Textbook:

Reference Books:

SEMESTER IV
CORE PAPER VIII – VISUAL OPTICS II

Course Description: This course deals with the concept of eye as an optical instrument and thereby covers various optical components of eye, types of refractive errors, clinical approach in diagnosis and management of various types of refractive errors.

Course Objectives: Upon completion of the course, the student should be able
- to understand the fundamentals of optical components of the eye
- to gain theoretical knowledge and practical skill on visual acuity measurement, objective and subjective clinical refraction.

Unit: I
Refractive conditions
- Emmetropia
- Myopia
- Hyperopia
- Astigmatism
- Accommodation
- Presbyopia
- Anisometropia and Aniseikonia
- Aphakia and Pseudophakia

Unit: II
Accommodation
- Far and near points of accommodation
- Correction of spherical ametropia
- Axial versus refractive ametropia
- Relationship between accommodation and convergence, AC / A ratio
Unit: III
Objective refraction
  ➢ Streak Retinoscopy only

Unit: IV
Subjective Refraction
  ➢ Review of subjective refractive methods
  ➢ Cross cylinder methods for astigmatism, Astigmatic Fan Test
  ➢ Difficulties in subjective and objective tests and their avoidance
  ➢ Ocular refraction versus spectacle refraction

Unit: V
Subjective Refraction
  ➢ Ocular accommodation versus spectacle accommodation
  ➢ Spectacle magnification and relative spectacle magnification
  ➢ Retinal image blur; depth of focus and depth of field
  ➢ Prescribing Prisms / Binocular Refraction

Text books:

Reference Books:
  • WJ Benjamin: Borish’s clinical refraction,2nd edition, Butterworth Heinemann, Missouri, USA,2006
  • T Grosvenor: Primary Care Optometry,4th edition, Butterworth – heinneman,USA,2002

SEMESTER IV

CORE PAPER IX – DISPENSING OPTICS

Course Description: This course will deal with the dispensing aspects of spectacle lenses and frames needed to manage the customer in an Optical set up, from counseling to delivering the spectacles.

Course Objective: Skills to be acquired at the end of this course

  • Reading of spectacle prescription
  • Counseling the patient
• Lens edge thickness calculation
• Frame & lens measurements and selection
• Writing spectacle lens order
• Facial measurements - Interpupillary distance measurement and measuring heights (single vision, multifocal, progressives)
• Lens verification and axis marking and fitting of all lens types
• Final checking of finished spectacle with frame adjustments
• Delivery and follow-up
• Troubleshooting complaints and handling patient’s questions.

Unit: I
Components of spectacle prescription & interpretation, transposition, Add and near power relation - Frame selection – based on spectacle prescription, professional requirements, age group, face shape

Unit: II
Measuring Inter-pupillary distance (IPD) for distance & near, bifocal height
Lens & Frame markings, Pupillary centers, bifocal heights, Progressive markings & adjustments – facial wrap, pantoscopic tilt

Unit: III
Recording and ordering of lenses (power, add, diameter, base, material, type, lens enhancements)
Neutralization – Hand & lensometer, axis marking, prism marking
Faults in spectacles (lens fitting, frame fitting, patients complaints, description, detection and correction)
Final checking & dispensing of spectacles to customers, counseling on wearing & maintaining of spectacles, Accessories – Bands, chains, boxes, slevets, cleaners, screwdriver kit
Spectacle repairs – tools, methods, soldering, riveting, frame adjustments

Unit: IV
Special types of spectacle frames
➢ Monocles
➢ Ptosis crutches
➢ Industrial safety glasses
➢ Welding glasses

Unit: V
Frame availability in Indian market, FAQ’s by customers and their ideal answers

Text Book:

• David Wilson: Practical Optical Dispensing, OTEN- DE, NSW TAFE Commission, 1999
Reference Book:

- David Wilson, Steve stenersen: Practical optical workshop, OTEN- DE, NSW TAFE Commission, 2002

SEMESTER IV

CORE PAPER X – SYSTEMIC DISEASE

Course Description: This course deals with definition, classification, clinical diagnosis, complications, and management of various systemic diseases. In indicated cases ocular manifestations also will be discussed.

Course Objectives: At the end of the course, students should get acquainted with the following:

- Common Systemic conditions: Definition, diagnostic approach, complications and management options
- Ocular findings of the systemic conditions
- First Aid knowledge

Unit: I
Hypertension
- Definition, classification, Epidemiology, clinical examination, complications, and management.
- Hypertensive retinopathy

Diabetes Mellitus
- Classification, pathophysiology, clinical presentations, diagnosis, and management, Complications
- Diabetic Retinopathy

Thyroid Disease
- Physiology, testing for thyroid disease, Hyperthyroidism, Hypothyroidism, Thyroiditis, Thyroid tumors
- Grave’s Ophthalmopathy

Acquired Heart Disease
- Ischemic Heart Disease, Congestive heart failure, Disorders of cardiac rhythm
- Ophthalmic considerations

Cancer :
- Incidence
- Etiology
- Therapy
- Ophthalmologic considerations
Unit: II
Connective Tissue Disease
- Rheumatic arthritis
- Systemic lupus erythematosus
- Scleroderma
- Polymyositis and dermatomyositis
- Sjogren syndrome
- Behcet’s syndrome
- Eye and connective tissue disease

Tuberculosis
Aetiology, pathology, clinical features, pulmonary tuberculosis, diagnosis, complications, treatment tuberculosis and the eye.

Herpes virus (Herpes simplex, Varicella Zoster, Cytomegalovirus, Epstein Barr Virus)
Herpes and the eye - Hepatitis (Hepatitis A, B, C)
Acquired Immunodeficiency Syndrome - Anemia (Diagnosis, clinical evaluation, consequences, Sickle cell disease, treatment, Ophthalmologic considerations)

Unit: III
Common Tropical Medical Ailments
- Malaria
- Typhoid
- Dengue
- Filariases
- Onchocerciasis
- Cysticercosis
- Leprosy

Unit: IV
Nutritional and Metabolic disorders:
- Obesity
- Hyperlipidaemias
- Kwashiorkor
- Vitamin A Deficiency
- Vitamin D Deficiency
- Vitamin E Deficiency
- Vitamin K Deficiency
- Vitamin B1,B2, Deficiency
- Vitamin C Deficiency

Myasthenia Gravis
- First Aid
- General Medical Emergencies
- Preoperative precautions in ocular surgeries

Psychiatry
- Basic knowledge of psychiatric condition and
- Patient Management
Unit: V
Genetics
- Introduction to genetics
- Organisation of the cell
- Chromosome structure and cell division
- Gene structure and basic principles of Genetics.
- Genetic disorders and their diagnosis.
- Genes and the eye
- Genetic counseling and genetic engineering.

Text book:
- Basic and clinical Science course: Update on General Medicine, American Academy of Ophthalmology, Section 1, 1999

SEMESTER IV
CORE PRACTICAL II – EXAMINATION OF VISUAL SYSTEM
(Examination at the end of second semester)

1. History taking - General, Specific, Conditions
2. Lensometry
3. Vision Check, Pinhole acuity
4. Push up test (Amplitude of Accommodation)
5. Push up test (Near point of Convergence)
6. Tear Break up time
7. Amsler’s Grid test
8. Color vision test
9. Schirmer’s test
10. Confrontation test
11. Slit lamp examination
12. Finger tension, Schiotz Tonometry, Applanation Tonometry
13. Negative Relative Accommodation
14. Positive Relative Accommodation
15. von Herick Grading of Anterior chamber depth
16. Accommodative facility(± 2.00 D)
17. IPD
18. HVID
19. Maddox rod (Phoria)
20. Negative Fusional vergence
21. Positive Fusional Vergence
22. Retinoscopy - Static, Dynamic and Cycloplegic Retinoscopy
23. Keratometry
24. Subjective Refraction – JCC, Clock Dial, Duochrome, Borish Delayed
SEMESTER IV
ALLIED PAPER IV – PATHOLOGY

**Course Description:** This course describes basic aspects of disease processes with reference to specific entities relevant in optometry/ophthalmology.

**Course Objective:** At the end of the course students will acquire knowledge in the following aspects:
- Inflammation and repair aspects.
- Pathology of various eye parts and adnexa

**Unit: I**
General Pathology : Principles
Pathophysiology of Ocular Angiogenesis
Ocular Infections

**Unit: II**
Pathology of cornea and Conjunctiva
Pathology of Uvea
Pathology of Glaucoma

**Unit: III**
Pathology of Retina
Pathology of retina in systemic disease/disorders
Pathology of eyelids and adnexa

**Unit: IV**
Pathology of orbital space occupying lesions
Pathology of the optic nerve

**Unit: V**
Retinoblastoma
Pathology of Lens

**Text books:**

**Reference books:**
SEMESTER V
CORE PAPER XI– CONTACT LENS I

Course Description: The subject provides the student with suitable knowledge both in theoretical and practical aspects of Contact Lenses.

Course Objectives: Upon completion of the course, the student should be able to:
- Understand the basics of contact lenses
- List the important properties of contact lenses
- Finalise the CL design for various kinds patients
- Recognize various types of fitting
- Explain all the procedures to patient
- Identify and manage the adverse effects of contact lens

Unit: I
Introduction to Contact lenses
  ➢ Definition
  ➢ Classification / Types
  ➢ History of Contact Lenses

Unit: II
Optics of Contact Lenses
  ➢ Magnification & Visual field
  ➢ Accommodation & Convergence
  ➢ Back & Front Vertex Power / Vertex distance calculation

Review of Anatomy & Physiology of
  ➢ Tear film
  ➢ Cornea
  ➢ Lids & Conjunctiva

Unit: III
Introduction to CL materials
  ➢ Monomers, Polymers
Properties of CL materials
  ➢ Physiological (Dk, Ionicity, Water content)
  ➢ Physical (Elasticity, Tensile strength, Rigidity)
  ➢ Optical (Transmission, Refractive index)

Indications and contraindications Parameters / Designs of Contact Lenses & Terminology

RGP Contact Lens materials
Manufacturing Rigid and Soft Contact Lenses – various methods

Unit: IV
Pre-Fitting examination – steps, significance, recording of results
Correction of Astigmatism with RGP lens
Types of fit – Steep, Flat, Optimum – on spherical cornea with spherical lenses
Types of fit – Steep, Flat, Optimum – on Toric cornea with spherical lenses
Calculation and finalising Contact lens parameters
Ordering Rigid Contact Lenses – writing a prescription to the Laboratory
Checking and verifying Contact lenses from Laboratory
Modifications possible with Rigid lenses

**Unit: V**

Common Handling Instructions
- Insertion & Removal Techniques
- Do’s and Don’ts

Care and Maintenance of Rigid lenses
- Cleaning agents & Importance
- Rinsing agents & Importance
- Disinfecting agents & importance
- Lubricating & Enzymatic cleaners

Follow up visit examination
Complications of RGP lenses

**Text books:**
- IACLE modules 1 - 10
- CLAO Volumes 1, 2, 3

**Reference books:**
2. Elisabeth A. W. Millis: Medical Contact Lens Practice, Butterworth-Heinemann, 2004

**SEMESTER V**
**CORE PAPER XII – OCULAR DISEASE I**

**Course Description:** This course deals with various ocular diseases affecting various parts of the eyes. It covers clinical signs and symptoms, cause, pathophysiological mechanism, diagnostic approach, differential diagnosis and management aspects of the ocular diseases.

**Course Objective:** At the end of the course the students will be knowledgeable in the following aspects of ocular diseases: knowledge
- on the etiology,
- epidemiology,
- symptoms,
- signs,
- course sequelae of ocular disease,
- diagnostic approach, and
- management of the ocular diseases.
Unit: I
a) ORBIT
   - Applied Anatomy
   - Proptosis
     Classification, Causes, Investigations
   - Enophthalmos
   - Developmental Anomalies
     (craniosynostosis, Craniofacial Dysostosis, Hypertelorism, Median facial cleft syndrome)
   - Orbital Inflammations (Preseptal cellulites, Orbital cellulitis Orbital Periostitis, cavernous sinus Thrombosis)
   - Grave’s Ophthalmopathy
   - Orbital tumors (Dermoids, capillary haemangioma, Optic nerve glioma)
   - Orbital blowout fractures
   - Orbital surgery (Orbitotomy)
   - Orbital tumors
   - Orbital trauma
   - Approach to a patient with proptosis

Unit: II
b) LIDS
   - Applied Anatomy
   - Congenital anomalies
     (Ptosis, Coloboma, Epicanthus, Distichiasis, Cryptophthalmos)
   - 3. Oedema of the eyelids
     (Inflammatory, Solid, Passive edema)
   - Inflammatory disorders (Blepharitis, External Hordeolum, Chalazion,
     Internal hordeolum, Molluscum Contagiosum)
   - Anomalies in the position of the lashes and Lid Margin (Trichiasis, Ectropion, Entropion,
     Symblepharon, Blepharophimosis, Lagophthalmos, Blepharospasm, Ptosis).
   - Tumors (Papillomas, Xanthelasma, Haemangioma, Basal carcinoma, Squamous cell carcinoma, sebaceous gland melanoma)

c) LACRIMAL SYSTEM
   - Applied Anatomy
   - Tear Film
   - The Dry Eye (Sjogren’s Syndrome)
   - The watering eye (Etiology, clinical evaluation)
   - Dacryocystitis
   - Swelling of the Lacrimal gland (Dacryoadenitis)

Unit: III
d) CONJUNCTIVA
   - Applied Anatomy
   - Inflammations of conjunctiva
     (Infective conjunctivitis – bacterial, chlamydial, viral, Allergic conjunctivitis, Granulomatous conjunctivitis)
Degenerative conditions
( Pinguecula, Pterygium, Concretions)
Symptomatic conditions
( Hyperaemia, Chemosis, Ecchymosis, Xerosis, Discoloration)
5. Cysts and Tumors

Unit: IV
e) CORNEA
Applied Anatomy and Physiology
Congenital Anomalies
(Megalocornea, Microcornea, Cornea plana, Congenital cloudy cornea)
Inflammations of the cornea (Topographical classifications: Ulcerative keratitis and Non ulcerative
Etiological classifications: Infective, Allergic, Trophic, Traumatic, Idiopathic)
Degenerations ( classifications, Arcus senilis, Vogt’s white limbal girdle, Hassal-henle bodies, Lipoid Keratopathy, Band shaped keratopathy, Salzmann’s nodular degeneration, Droplet keratopathy, Pellucid Marginal degeneration)
Dystrophies ( Reis Buckler dystrophy, Recurrent corneal erosion syndrome, Granular dystrophy, Lattice dystrophy, Macular dystrophy, cornea guttata, Fuch’s epithelial endothelial dystrophy, Congenital hereditary endothelial dystrophy)
Keratoconus, Keratoglobus
Corneal oedema, Corneal opacity, Corneal vascularisation
Penetrating Keratoplasty

Unit: V
f) UVEAL TRACT AND SCLERA
Applied Anatomy,
Classification of uveitis
Etiology
Pathology
Anterior Uveitis
Posterior Uveitis
Purulent Uveitis
Endophthalmitis
Panophthalmitis
Pars Planitis
Tumors of uveal tract (Melanoma)
Episcleritis and scleritis
Clinical examination of Uveitis and Scleritis

Text books:
Reference Books:


SEMESTER V
CORE PAPER XIII – BINOCULAR VISION I

Course Description:
This course provides theoretical aspects of Binocular Vision and its clinical application. It deals with basis of normal binocular vision and space perception, Gross anatomy and physiology of extrocular muscles, various binocular vision anomalies, its diagnostic approaches and management.

Course Objectives:

- On successful completion of this module, a student will be expected to be able to:-
- Demonstrate an in-depth knowledge of the gross anatomy and physiology relating to the extrocular muscles.
- Provide a detailed explanation of, and differentiate between the aetiology, investigation and management of binocular vision anomalies.
- Adapt skills and interpret clinical results following investigation of binocular vision anomalies appropriately and safely.

Unit: I
Binocular Vision and Space perception.
- Relative subjective visual direction.
- Retino motor value.
- Grades of BSV.
- SMP and Cyclopean Eye.
- Correspondence.
- Fusion, Diplopia, Retinal rivalry.
- Horopter.
- Physiological Diplopia and Suppression.
- Stereopsis, Panum’s area, BSV.
- Stereopsis and monocular clues - significance.
- Egocentric location, clinical applications.
- Theories of Binocular vision.

Unit: II
Anatomy of Extra Ocular Muscles.
- Rectii and Obliques, LPS.
- Innervation & Blood Supply.
Physiology of Ocular movements.
- Center of rotation, Axes of Fick.
- Action of individual muscle.

Laws of ocular motility
- Donder’s and Listing’s law
- Sherrington’s law
- Hering’s law

Unit: III
Uniocular & Binocular movements - fixation, saccadic & pursuits.
- Version & Vergence.
- Fixation & field of fixation

Near Vision Complex
Accommodation
- Definition and mechanism (process).
- Methods of measurement.
- Stimulus and innervation.
- Types of accommodation.
- Anomalies of accommodation – aetiology and management.

Unit: IV
Convergence
- Definition and mechanism.
- Methods of measurement.
- Types and components of convergence - Tonic, accommodative, fusional, proximal.
- Anomalies of Convergence – aetiology and management.

Sensory adaptations Confusion
Suppression Investigations
Management Blind spot syndrome

Unit: V
Abnormal Retinal Correspondence
Investigation and management
Blind spot syndrome
Eccentric Fixation
Investigation and management
Amblyopia Classification
Aetiology Investigation Management

Text Books:

4. Mitchell Scheiman; Bruce Wick: Clinical Management of Binocular Vision Heterophoric, Accommodative, and Eye Movement Disorders, 2008, Lippincot Williams & Wilkins publishers

SEMESTER V
CORE PAPER XIV – LOW VISION AID

Course Description: This course deals with the definition of low vision, epidemiology aspect of visual impairment, types of low vision devices and its optical principles, clinical approach of the low vision patients, assistive devices for totally visually challenged, art of prescribing low vision devices and training the low vision patients and other rehabilitation measures.

Course Objectives: At the end of the course, the student will be knowledgeable in the following:

- Definition and epidemiology of Low Vision
- Clinical examination of Low vision subjects
- Optical, Non-Optical, Electronic, and Assistive devices.
- Training for Low Vision subjects with Low vision devices
- Referrals and follow-up

Unit: I
Definitions & classification of Low vision
Epidemiology of low vision

Unit: II
Model of low vision service
Pre-clinical evaluation of low vision patients – prognostic & psychological factors; psycho-social impact of low vision, Types of low vision aids – optical aids, non-optical aids & electronic devices

Unit: III
Optics of low vision aids
Clinical evaluation – assessment of visual acuity, visual field, selection of low vision aids, instruction & training, Pediatric Low Vision care

Unit: IV
Low vision aids – dispensing & prescribing aspects
Visual rehabilitation & counseling
Legal aspects of Low vision in India

Unit: V
Case Analysis


**Text books:**
- **Christine Dickinson:** Low Vision: Principles and Practice Low vision care, E Vaithilingam: practice of

**Reference Books:**
- **Helen Farral:** optometric Management of Visual Handicap, Blackwell Scientific publications, 1991
- **A J Jackson, J S Wolffsohn:** Low Vision Manual, Butterworth Heinnemann, 2007

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**SEMESTER V
CORE PAPER XV – OCCUPATIONAL OPTOMETRY**

**Course Description :** This course deals with general aspects of occupational health, Visual demand in various job, task analyzing method, visual standards for various jobs, occupational hazards and remedial aspects through classroom sessions and field visit to the factories.

**Course Objectives:** At the end of the course the students will be knowledgeable in the following aspects:
- in visual requirements of jobs;
- in effects of physical, chemical and other hazards on eye and vision;
- to identify occupational causes of visual and eye problems;
- to be able to prescribe suitable corrective lenses and eye protective wear and
- to set visual requirements, standards for different jobs.

**Unit: I**
Introduction to Occupational health, hygiene and safety, international bodies like ILO, WHO, National bodies etc, Acts and Rules - Factories Act, WCA,ESI Act.

**Unit: II**
Electromagnetic Radiation and its effects on Eye
Light – Definitions and units, Sources, advantages and disadvantages, standards
Color – Definition, Color theory, Color coding, Color defects, Color Vision tests

**Unit: III**
Occupational hazards and preventive/protective methods
Task Analysis

**Unit: IV**
Industrial Vision Screening – Modified clinical method and Industrial Vision test
Vision Standards – Railways, Roadways, Airlines

**Unit: V**
Visual Display Units
Contact lens and work
Text Books:

Reference Books:
• G W Good: Occupational Vision Manual available in the following website: www.aoa.org
• N.A. Smith: Lighting for Occupational Optometry, HHSC Handbook Series, Safchem Services, 1999
• G Carson, S Doshi, W Harvey: Eye Essentials: Environmental & Occupational Optometry, Butterworth-Heinemann, 2008

SEMESTER VI
CORE PAPER XV I – CONTACT LENS II

Course Description: The subject provides the student with suitable knowledge both in theoretical and practical aspects of Contact Lenses.

Course Objectives: Upon completion of the course, the student should be able to:
• Understand the basics of contact lenses
• List the important properties of contact lenses
• Finalise the CL design for various kinds patients
• Recognize various types of fitting
• Explain all the procedures to patient
• Identify and manage the adverse effects of contact lens

Unit: I
SCL Materials & Review of manufacturing techniques
Comparison of RGP vs. SCL
Pre-fitting considerations for SCL
Fitting philosophies for SCL

Unit: II
SCL fitting assessment
Types of fit – Steep, Flat, Optimum
Calculation and finalising SCL parameters

Disposable lenses
  Advantages and availability

Unit: III
Soft Toric CL
  ➢ Stabilization techniques
Parameter selection
Fitting assessment

Unit: IV
Common Handling Instructions
- Insertion & Removal Techniques
- Do’s and Don’ts

Care and Maintenance of Soft lenses
- Cleaning agents & Importance
- Rinsing agents & Importance
- Disinfecting agents & importance
- Lubricating & Enzymatic cleaners

Follow up visit examination
Complications of Soft lenses
Therapeutic contact lenses
- Indications
- Fitting consideration

Unit: V
Specialty fitting
- Aphakia
- Pediatric
- Post refractive surgery
- Introduction to Bifocal CL

Text books:
- IACLE modules 1 - 10
- CLAO Volumes 1, 2, 3

Reference books:
- Elisabeth A. W. Millis: Medical Contact Lens Practice, Butterworth-Heinemann, 2004

SEMESTER VI
CORE PAPER XVII – OCULAR DISEASE II

Course Description: This course deals with various ocular diseases affecting various parts of the eyes. It covers clinical signs and symptoms, cause, pathophysiological mechanism, diagnostic approach, differential diagnosis and management aspects of the ocular diseases.

Course Objective: At the end of the course the students will be knowledgeable in the following aspects of ocular diseases: knowledge
- on the etiology,
- epidemiology,
- symptoms,
- signs,
- course sequelae of ocular disease,
- diagnostic approach, and
- Management of the ocular diseases.

**Unit: I**

**Retina and Vitreous:**
- Applied Anatomy
- Congenital and Developmental Disorders (Optic Disc: Coloboma, Drusen, Hypoplasia, Medullated nerve fibers; Persistent Hyaloid Artery)
- Inflammatory disorders (Retinitis: Acute purulent, Bacterial, Virus, mycotic)
- Retinal Vasculitis (Eales’s)
- Retinal Artery Occlusion (Central retinal Artery occlusion)
- Retinal Vein occlusion (Ischaemic, Non Ischaemic, Branch retinal vein occlusion)
- Retinal degenerations: Retinitis Pigmentosa, Lattice degenerations
- Macular disorders: Solar retinopathy, central serous retinopathy, cystoid macular edema, Age related macular degeneration.
- Retinal Detachement: Rhegmatogenous, Tractional, Exudative
- Retinoblastoma

**Unit: II**

**Ocular Injuries:**
Terminology: Closed globe injury (contusion, lamellar laceration) Open globe injury (rupture, laceration, penetrating injury, perforating injury)
- Mechanical injuries (Extraocular foreign body, blunt trauma, perforating injury, sympathetic ophthalmitis)
- Non Mechanical Injuries (Chemical injuries, Thermal, Electrical, Radiational)
- Clinical approach towards ocular injury patients

**Unit: III**

**Lens**
- Applied Anatomy and Physiology
- Clinical examination
- Classification of cataract
- Congenital and Developmental cataract
- Acquired (Senile, Traumatic, Complicated, Metabolic, Electric, Radiational, Toxic)
- Morphological: Capsular, Subcapsular, Cortical, Supranuclear, Nuclear, Polar
- Management of cataract (Non surgical and surgical measures; preoperative evaluation, Types of surgeries,)
- Complications of cataract surgery
- Displacement of lens: Subluxation, Displacement
- Lens coloboma, Lenticonus, Microsperophakia.
Unit: IV
Clinical Neuro-ophthalmology
- Anatomy of visual pathway
- Lesions of the visual pathway
- Pupillary reflexes and abnormalities (Amaurotic light reflex, Efferent pathway defect, Wernicke’s hemianopic pupil, Marcus gunn pupil, Argyll Robertson pupil, Adie’s tonic pupil)
- Optic neuritis, Anterior Ischemic optic neuropathy, Pappilloedema, optic atrophy
- Cortical blindness
- Malingering
- Nystagmus
- Clinical examination

Unit: V
Glaucoma
- Applied anatomy and physiology of anterior segment
- Clinical Examination
- Definitions and classification of glaucoma
- Pathogenesis of glaucomatous ocular damage
- Congenital glaucomas
- 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 Glaucomas
Management: common medications, laser intervention and surgical techniques

Text books:

Reference Books:

SEMESTER VI
CORE PAPER XVIII – BINOCULAR VISION II

Course Description:
This course provides theoretical aspects of Binocular Vision and its clinical application. It deals with basis of normal binocular vision and space perception, Gross anatomy and physiology of extrocular muscles, various binocular vision anomalies, its diagnostic approaches and management.
Course Objectives:

- On successful completion of this module, a student will be expected to be able to:
- Demonstrate an in-depth knowledge of the gross anatomy and physiology relating to the extraocular muscles.
- Provide a detailed explanation of, and differentiate between the aetiology, investigation and management of binocular vision anomalies.
- Adapt skills and interpret clinical results following investigation of binocular vision anomalies appropriately and safely.

Unit: I
Neuro-muscular anomalies, Classification and etiological factors
History – recording and significance.

Convergent strabismus

- Accommodative convergent squint
- Classification
- Investigation and Management
- B Non accommodative Convergent squint
- Classification
- Investigation and Management

Unit: II
Divergent Strabismus
Classification
A& V phenomenon
Investigation and Management

Unit: III
Vertical strabismus
Classification
Investigation and Management

Unit: IV
Paralytic Strabismus
Acquired and Congenital
Clinical Characteristics
Distinction from comitant and restrictive Squint
Investigations

- History and symptoms
- Head Posture
- Diplopia Charting
Unit: IV
Restrictive Strabismus
Features
- Musculo fascical anomalies
- Duane’s Retraction syndrome
- Clinical features and management
- Brown’s Superior oblique sheath syndrome
- Strabismus fixus
- Congenital muscle fibrosis
- Surgical management

Text Books:

4. Mitchell Scheiman; Bruce Wick: Clinical Management of Binocular Vision Heterophoric, Accommodative, and Eye Movement Disorders, 2008, Lippincot Williams & Wilkins publishers

SEMESTER VI
CORE PAPER XIX– GERIATRIC & PEDIATRIC OPTOMETRY

Course Description: This course deals with general and ocular physiological changes of ageing, common geriatric systemic and ocular diseases, clinical approach in geriatric patients, pharmacological aspects of ageing, and spectacle dispensing aspects in ageing patients.

And provide the students adequate knowledge in theoretical and practical aspects of diagnosis, and management of eye conditions related to pediatric population. Also it will inculcate the skill of transferring/communicating the medical information to the attender/patient by the students.

The scope of this subject is to train the optometrists to develop a systematic way of dealing with children below 12, so as to implement primary eye care and have better, specialized management of anomalies.

Course Objectives:
The student on taking this course should
- be able to identify, investigate the age related changes in the eyes.
• be able to dispense spectacles with proper instructions.
• adequately gained knowledge on common ocular diseases
• have a knowledge of the principal theories of childhood development, and visual development
• have the ability to take a thorough paediatric history which encompasses the relevant developmental, visual, medical and educational issues
• be familiar with the accommodative-vergence system, the genesis of ametropia, the disorders of refraction, accommodation and vergence, and the assessment and management of these disorders
• be familiar with the aetiology, clinical presentation and treatment of amblyopia, comitant strabismus and commonly presenting incomitant strabismus
• have a knowledge of the epidemiology of eye disease in children, the assessment techniques available for examining visual function of children of all ages and an understanding varied management concepts of paediatric vision disorders
• have knowledge of the art of dispensing contact lens, low vision aids and referral to the surgeon or other specialists at the appropriate timing.

Unit: I
Geriatric Optometry
Structural, and morphological changes of eye in elderly Physiological changes in eye in the course of aging.

Introduction to geriatric medicine – epidemiology, need for optometry care, systemic diseases (Hypertension, Atherosclerosis, coronary heart disease, congestive Heart failure, Cerebrovascular disease, Diabetes, COPD)

Optometric Examination of the Older Adult

Unit: II
Ocular diseases common in old eye, with special reference to cataract, glaucoma, macular disorders, vascular diseases of the eye
Contact lenses in elderly
Pharmacological aspects of aging
Low vision causes, management and rehabilitation in geriatrics.
Spectacle dispensing in elderly – Considerations of spectacle lenses and frames

Unit: III
Pediatric optometry
Pediatric optometry
The Development of Eye and Vision
History taking: Paediatric subjects
Assessment of visual acuity
Normal appearance, pathology and structural anomalies of
  a) Orbit, Eye lids, Lacrimal system,
b) Conjunctiva, Cornea, Sclera
Anterior chamber, Uveal tract, Pupil

c) Lens, vitreous, Fundus
Oculomotor system

**Unit: IV**
Refractive Examination
Determining binocular status
Determining sensory motor adaptability
Compensatory treatment and remedial therapy for: Myopia, Pseudomyopia, Hyperopia, Astigmatism, Anisometropia, Amblyopia
Remedial and Compensatory treatment of Strabismus and Nystagmus

**Unit: V**
Paediatric eye disorders: Cataract, Retinopathy of Prematurity, Retinoblastoma, Neuromuscular conditions (myotonic dystrophy, mitochondrial cytopathy), and Genetics
Anterior segment dysgenesis, Aniridia, Microphthalmos, Coloboma, Albinism
Spectacle dispensing for children
Paediatric contact lenses
Low vision assessment in children

**Text books:**


**References:**

1. OP Sharma: Geriatric Care – A textbook of geriatrics and Gerontology, viva books, New Delhi, 2005
3. DE Rosenblatt, VS Natarajan: Primer on geriatric Care A clinical approach to the older patient, Printers Castle, Cochin, 2002
SEMESTER VI
CORE PRACTICAL III – CONTACT LENS & LOW VISION AID

1. Pre fitting evaluation
2. RGP CL insertion & Removal
3. Fitting assessment
4. Over refraction
5. Follow up examination
6. SCL insertion & Removal
7. Fitting assessment
8. Over refraction
9. Follow-up Examination
10. Toric contact lens fitting and assessment
11. Cosmetic contact lens fitting and assessment
12. Attending in low vision care clinic and history taking.
13. Determining the type of telescope and its magnification (Direct comparison method & calculated method)
14. Determining the change in field of view with different magnification and different eye to lens distances with telescopes and magnifiers.
15. Inducing visual impairment and prescribing magnification.
16. Determining reading speed with different types of low vision aids with same magnification.
17. Determining reading speed with a low vision aid of different magnifications.

ELECTIVE 1-A
NUTRITION

Course Description: This course covers the basic aspects of Nutrition for good health. It also includes nutrients and nutrient derivatives relevant to ocular health, nutrition deficiency and ocular disease, Nutrition and ocular aging, and contraindications, adverse reactions and ocular nutritional supplements.

Course Objective: At the end of the course student would have gained the knowledge of the following:
- Balanced diet.
- Protein, carbohydrates, vitamins, Minerals, carotenoids and eye.
- Nutrition and Ocular aging
- Adverse effects of ocular nutritional supplements

Unit: I
Introduction to Nutrition and Food Science, Food Groups and Food Pyramid
Balanced diet for different age groups, Recommended dietary Allowances
Assessment of Nutritional Status.
Unit: II
Digestion, absorption and transport of Food
Proteins and eye

Unit: III
Lipids and eye
Carbohydrates and eye
Vitamins and eye

Unit: IV
Minerals and trace elements and eye
Carotenoids and eye
Oxidative stress and the eye

Unit: V
Vitamin A, C and E deficiency
Nutrition and ocular aging
Contraindications, Adverse reactions and ocular nutritional supplements

Text books:
- C Gopalan, BV Rama Sastri, SC Balasubramanian: Nutritive Value of Indian Foods , National Institute of Nutrition, ICMR, Hyderabad,2004
- Frank Eperjesi & Stephen Beatty: Nutrition and the Eye A practical Approach,

ELECTIVE 2-A
COMMUNITY OPTOMETRY

Course Description: Introduction to the foundation and basic sciences of public health optometry with an emphasis on the epidemiology of vision problems especially focused on Indian scenario.

Course Objectives: At the end of the course students will be knowledgeable in the following areas:
- Community based eye care in India.
- Prevalence of various eye diseases
- Developing Information Education Communication materials on eye and vision care for the benefit of the public
- Organize health education programmes in the community
- Vision screening for various eye diseases in the community and for different age groups.
Unit: I
Public Health Optometry: Concepts and implementation
Dimensions, determinants and indicators of health
Levels of disease prevention and levels of health care patterns

Unit: II
Epidemiology of blindness – Defining blindness and visual impairment
Eye in primary health care
Contrasting between Clinical and community health programs

Unit: III
Community Eye Care Programs
Community based rehabilitation programs
Nutritional Blindness with reference to Vitamin A deficiency
Vision 2020: The Right to Sight

Unit: IV
Screening for eye diseases
National and International health agencies, NPCB
Role of an optometrist in Public Health
Organization and Management of Eye Care Programs – Service Delivery models
Health manpower and planning & Health Economics

Unit: V
Evaluation and assessment of health programmes
Optometrists role in school eye health programmes
Basics of Tele Optometry and its application in Public Health
Information, Education and Communication for Eye Care programs

Text books:
  o K Park: Park’s Text Book of Preventive and Social Medicine, 19th edition, Banarsidas Bhanot publishers, Jabalpur, 2007

Reference books:
  1. MC Gupta, Mahajan BK, Murthy GVS, 3rd edition. Text Book of Community Medicine, Jaypee Brothers, New Delhi, 2002

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