Annexure 40.2

Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be university under Category 'A' by MHRD, Estd.u/s 3 of UGC Act 1956)
Re-accredited with A++ Grade by NAAC. Recognized by UGC Under Section 12B
Coimbatore – 641043, Tamil Nadu, India

Conceptual Framework of Curriculum
UG Programmes
(With Language for one semester)
BACHELOR OF OPTOMETRY-B.OPTOM
For Students Admitted in 2022-2023 & Onwards

Sl. No.	Semester	Course / Components	Hours of instruction/ week/ Course	Number of Courses	Credit / Course	Total Credits
I	2	**Part-I** Tamil/French/Hindi	3	1	-	3
II	2	**Part-I** English	3	1	-	3
III	1-6	**Part – III** Core Course ❖ Theory	3-6	30-32	2-5	70-90
	1-6	❖ Practical (1-2 per semester)	3- 6/ Practical	4-8	2-4	16-24
	4-6	❖ Clinic/Hospital Posting	4-8	2-4	4	8-16
	5	❖ Self Study Course	1	1	4	4
	5	❖ Computer Based Test(CBT) (fundamentals/ Principles of domain subject)	-	1	2	2
	5-6	❖ Project	3-5	1	5	5
	7-8	❖ Internship **	6-8	4-6	5	40
	1-4	**Discipline Specific Elective(DSE)Courses** ❖ DSE courses One course / Semester DSE with practical MS Office (Subject related)	3T+1P/ 2T+2P	4	2-4	8
	5	**Generic Elective Course**	2	1	2	2
		Total				**179**

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Coimbatore – 641043, Tamil Nadu, India.

BACHELOR OF OPTOMETRY - B. OPTOM

Programme Outcomes:

1. Apply acquired knowledge of fundamental subjects to solve different problems.
2. Analyse various research and scientific problems.
3. Execute the remedial measures with appropriate safety, health, economy and environmentalconsiderations.
4. Solve complex scientific problems by conducting scientific derivations or mathematicalsimulations.
5. Utilize modern devices, software and available resources.
6. Apply their responsibilities in social and environmental context.
7. Exhibit professional ethics and norms of scientific development.
8. Function individually and in team work.
9. Perform effective communication in both verbal and written forms.
10. Administer the work and economy of research and project.
11. Pursue lifelong learning and acquaintance to compete the technological change.

Programme Specific Outcomes:

1. Acquire skills set in diagnostic, therapeutic, rehabilitative and preventive eye health care services.
2. Enable career in eye care, educational, community, research and industrial sectors.
3. Undertake entrepreneurship skills for setting up a private outlet and multi-disciplinary services.

Scheme of Instruction & Examination
(For the students admitted from 2022 -23 & onwards)

Part	*Subject Code*	*Name of the Paper/Component*	*Hrs. of Instruction/ Week*		*Scheme of Examination*					
			T	*P*	*Duration of Exam*		*CIA*	*CIE*	*Total*	*Credit*
					T	*P*				
		First Semester								
III		***Core Course***								
	22BOPC01	General Anatomy	4	-	3	-	50	50	100	3
	22BOPC02	General Physiology	3	1	3	-	50	50	100	3
	22BOPC03	Geometric Optics – I	4	1	3	-	50	50	100	3
	22BOPC04	Physical Optics	5	-	3	-	50	50	100	3
	22BOPC05	Microbiology	3	-	3	-	50	50	100	2
	22BOPC06	Practical I - Physical Optics	-	4	3	-	50	50	100	2
		Discipline Specific Elective(DSE) Course								
	22BOPD01	**DSE I** : Biochemistry	2	2	3	-	50	50	100	2
		Games	-	1	-	-	-	-	-	-
IV	22BXEC01	Eye Camp – I	-	-	-	-	100	-	100	1
		Second Semester								
I	22BLATA1/ 22BLAHI1/ 22BLAFR1	Tamil: Pothu tamil thazh I – Tamil Ilakkiam / Hindi: Grammar, Translation and General Essay/ French: Fundamentals of French	3	-	3	-	50	50	100	3
II	22BLEN02	English Language for Communication – II	3	-	3	-	50	50	100	3
		Core Course								
	22BOPC07	Ocular Anatomy	4	-	3	-	50	50	100	3

III	22BOPC08	Ocular Physiology	3	2	3	-	50	50	100	3
	22BOPC09	Geometric Optics – II	4	-	3	-	50	50	100	3
	22BOPC10	Nutrition	3	-	3	-	50	50	100	2
	22BOPC11	Practical II – Geometric Optics	-	3	3	-	50	50	100	2
	Discipline Specific Elective (DSE) Course									
	22BOPD02	**DSE II:** Digital Health	2	2	3	-	50	50	100	2
		Games	-	1	-	-	-	-	-	-
IV	22BXEC02	Eye Camp – II	-	-	-	-	100	-	100	1
	Third Semester									
	Core Course									
III	22BOPC12	Optometric Optics - I	3	-	3	-	50	50	100	2
	22BOPC13	Visual Optics – I	3	-	3	-	50	50	100	3
	22BOPC14	Optometric Instruments	3	-	3	-	50	50	100	3
	22BOPC15	Ocular Diseases – I	5		3	-	50	50	100	4
	22BOPC16	Clinical Examination of Visual System (CEVS)	4	1	3	-	50	50	100	3
	22BOPC17	Practical III - Clinical Examination of Visual System	-	4	3		50	50	100	3
	22BOPC18	Clinical Psychology	3	-	3	-	50	50	100	2
	Discipline Specific Elective (DSE) Course									
	22BOPD03	**DSE III**: Epidemiology and Biostatistics	2	2	3	-	50	50	100	2
IV	22BXEC03	Eye Camp – III	-	-	-	-	100	-	100	1
	Fourth Semester									
	Core Course									
III	22BOPC19	Optometric Optics – II	3	-	3	-	50	50	100	3
	22BOPC20	Visual Optics – II	3	1	3	-	50	50	100	3

	22BOPC21	Ocular Diseases – II	5	-	3	-	50	50	100	4
	22BOPC22	Pharmacology	3	-	3	-	50	50	100	2
	22BOPC23	Pathology	3	-	3	-	50	50	100	2
	22BOPC24	Monocular Sensory Perception	3	-	3	-	50	50	100	2
	22BOPC25	Clinics / Hospital Posting	-	5	-	-	100	-	100	4
	Discipline Specific Elective (DSE) Course									
	22BOPD04	**DSE IV:** Public Health and Community Optometry	2	2	3	-	50	50	100	2
IV	22BXEC04	Eye Camp – IV	-	-	-	-	100	-	100	1
Hospital Posting During Summer Vacation 30 days										
Fifth Semester										
Core Course										
III	22BOPC26	Contact Lens – I	3	-	3	-	50	50	100	3
	22BOPC27	Binocular Vision – I	3	-	3	-	50	50	100	3
	22BOPC28	Dispensing Optics	3	-	3	-	50	50	100	3
	22BOPC29	Geriatric Optometry	3	-	3	-	50	50	100	2
	22BOPC30	Low Vision Aid	3	-	3	-	50	50	100	2
	22BOPC31	Occupational Optometry	3	-	3	-	50	50	100	2
	22BOPC32	Practical IV - Contact Lens and Low Vision Aid	-	2	3	-	50	50	100	2
	22BOPC33	Clinical Assessment – I	-	3	3	-	50	50	100	4
	22BOPC34	Hospital Management (Self Study)	1	-	3	-	100	-	100	4
	22BOPC35	Optometry (Computer Based Test)	-	-	1	-	-	100	100	2
	22BOPC36	Hospital Posting	-	4	-	-	100	-	100	4
		Generic Elective Course	2	-	3	-	100	-	100	2
IV	22BXEC05	Eye Camp – V	-	-	-	-	100	-	100	1

Sixth Semester										
Core Course										
III	22BOPC37	Contact Lens – II	3	1	3	-	50	50	100	3
	22BOPC38	Binocular Vision – II	4	1	3	-	50	50	100	3
	22BOPC39	Paediatric Optometry	3	-	3	-	50	50	100	2
	22BOPC40	Systemic Disease	3	-	3	-	50	50	100	2
	22BOPC41	Law and Optometry	3	-	3	-	50	50	100	2
	22BOPC42	Practical V - Binocular Vision and Paediatric Optometry	-	3	3	-	50	50	100	3
	22BOPC43	Clinical Assessment – II	-	5	3	-	50	50	100	4
	22BOPC44	Project	-	4	-	-	100	-	100	4
IV	22BXEC06	Eye Camp – VI	-	-	-	-	100	-	100	1
Seventh Semester										
Core Course										
III	22BOPC45	Internship in Comprehensive eye Check Up	-	8	-	3	50	50	100	5
	22BOPC46	Internship in Cornea and Refractive Surgeries	-	8	-	3	50	50	100	5
	22BOPC47	Internship in Contact lens and Opticals	-	8	-	3	50	50	100	5
	22BOPC48	Internship in Glaucoma Clinic	-	6	-	3	50	50	100	5
Eighth Semester										
Core Course										
III	22BOPC49	Internship in Neuro Clinic	-	8	-	3	50	50	100	5
	22BOPC50	Internship in Pediatric and Binocular Vision Clinic	-	8	-	3	50	50	100	5
	22BOPC51	Internship in Retina Clinic	-	8	-	3	50	50	100	5
	22BOPC52	Internship in Community OPD	-	6	-	3	50	50	100	5
Total Credits for Part I, II & III										**179**
Total Credits for Part IV										**6**
Total Credits										**185**

Annexure 38.1

Part - IV COMPONENTS

Applicable for B.Sc. Physician Assistant, Bachelor of Optometry (B.Optom), Bachelor in Audiology and Speech Language Pathology (B.ASLP), Bachelor of Physiotherapy (BPT) students admitted in the academic year 2022-2023 & onwards.

S.No.	Components	Subject Code	Semester	No. of Credits
I	**A. Ability Enhancement Courses**			
	Environmental Studies	21BAES01	I	4
	Fundamentals of Research	21BAFU01	II	2
	Communication Skills	23BSCS01	V	2
	Soft Skills	23BSSS01	VI	2
II	**Skill Enhancement Course(SEC)**			
a.	**Value Added Course**	40 Hrs. Duration	III	2
b.	**Co - Curricular Course**	Varied duration	IV	2
	B. Extra - Curricular Course			
	NCC/	**21BXNC01-06**	1-6	24 Credits*
	NSS/	**21BXNS01-06**		6 Credits
	Sports/	**21BXSP01-06**		6 Credits
	Medical Camp (for B.Sc. Physician Assistant and Bachelor in Audiology and Speech Language Pathology Students) /	**22BXMC01-06 /**		6 Credits
	Eye Camp (for Bachelor of Optometry students) /	**22BXEC01-06 /**		6 Credits
	Workstation Ergonomics (for Bachelor of Physiotherapy students)	**22BXWE01-06**		6 Credits
	Clinical Posting (For Bachelor in Audiology and Speech Language Pathology Students alone)	**22BXCP01-05**	2-6	5 Credits
			Total Credits	**38/20/ 43/25 (for B.ASLP)**

General Anatomy

Semester I **Hours of Instruction/week: 4**

22BOPC01 **No of Credits: 3**

Objectives:

- To understand the structure of our human body.
- To comprehend the gross, functional and applied anatomy of various structures in the human body.
- To identify and locate the source of the disease.

Unit I Human body as a whole, skeletal system **15**

Subdivisions of Anatomy - Regional and Systemic Anatomy, Planes of the Body, Terminology, Cavities and system of the body, Cells and various types of tissues of the body, Skeletal System - Bones of the body. Joints - Classification, Joints of the body. Epithelium and glands of the body.

Unit II Skin, Muscles and glands **10**

Anatomical differences in different areas, functional and protective variations, innervations, relationship with muscles and nerves. Different types of muscles, their functional differentiation, their relationship with different structures, their neural supply, different types of glands (exocrine and endocrine), functional differences, neural control of glands.

Unit III Blood vessels and Lymphatic system **10**

Differentiation between arteries and veins, embryology, histology of both arteries and veins, Functional differences between the two, anatomical differences at different locations. Functions, relationship with blood vessels and organs.

Unit IV Head, Neck and Special Senses **10**

Scalp. Face- Facial bones, Temporo Mandibular Joint, facial muscles, Facialnerve,Arteries, Applied anatomy of face. Structures of neck, Triangles of neck. Other areas-Parotid region, Temporal and Infra-temporal fossae. Sub-mandibular region. Mouth- boundaries, structures, soft and hard Palate, Pharynx, Larynx, blood vessels and lymphatic drainage of head and neck. Outline anatomy of special senses.

Unit V Nervous system, Human Brain and Cranial Nerves **15**

Cranial cavity - Cranial fossa, Meninges, Duramater, Spinal cord - spinal segments, external features and internal structure. Brain - medulla oblongata, pons, mid-brain, cerebellum and cerebrum, Ventricles, cerebrospinal fluid, circle of willis. Cranial Nerves and Spinal nerves. Pyramidal and extra pyramidal motor systems, upper and lower motor neurons. Parts of Nervous system, cell types of nervous system, Autonomic nervous system - Sympathetic and para sympathetic nervous system, Central Nervous system.

Total Hours 60

Texts Books:

1. B D Chaurasia: Handbook of general Anatomy, Third edition, CBS Publishers and Distributors, New Delhi - 110 032.
2. J.Tortora & N.P.Anagnostakos: Principles of Anatomy and Physiology.

Reference Books:

1. Gray's Anatomy: The Anatomical Basis of Clinical Practice. Elsevier Churchill Livingstone, 2021.
2. Williams, P. L., & Warwick, R. (1989). Gray's anatomy. Churchill Livingstone (36th to 42nd edition).
3. Mariano S.H.Difiore: Atlas of Human Histology, 5th Edn., 1981, Lea &Felige.

Course outcomes:

On the successful completion of the course, students will be able to

CO1. To comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the human body.

CO2. To learn about the muscles and glands of human body.

CO3. To discuss the mechanics of blood supply and its relationship to organs.

CO4. To comprehend the anatomy of head and neck.

CO5. To inspect the anatomy of nervous system and cranial nerves.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	L	H	M	L	M	M	L	M	L	L	H	M	M
CO 2	H	M	M	L		M	L			M	M	M	L	L
CO 3	H	L	M	M	M	M				L	M	M	L	L
CO 4	H	H	H	M	M	M	M	L	L	L	M	M	L	L
CO 5	H	H	M	M	H	H	M	M	M	M	H	M	M	M

General Physiology

Semester I
22BOPC02

Hours of Instruction/week: 3+1
No of Credits: 3

Objectives:

- To explain the normal functioning of various organs of the body and their interactions.
- To elucidate the physiological aspects of normal growth and development.
- To know the physiological principles underlying pathogenesis of disease.

Unit I Cell structure, its organization and Blood **10**

Tissue organization, Epithelium, Connective tissue - Collagen fibres, Elastic fibres, Areolar fibres. 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. Development, morphology & measurements - functions & dysfunctions of RBC, WBC and Platelets. Clotting-factors, mechanism, anti- coagulants dysfunctions. Blood grouping –classification, importance in transfusion, Rh factor & incompatibility, Suspension stability. Osmotic stability and Reticuloendothelial system – Spleen, lymphatic tissue, Thymus, bone marrow, immune system, cellular, Humoral, Autoimmune.

Unit II Environmental Physiology, Circulatory and Respiratory system **10**

Environmental physiology - Body temperature regulation (including skin Physiology). Exposure to low and high atmospheric pressure. **Circulatory system**- General principles. Heart – myocardium, innervation, transmission of cardiac impulse. Events during cardiac cycle, cardiac output. Peripheral circulation- peripheral resistances, arterial blood pressure. Measurements – factors regulation variations, capillary circulation and venous circulation. Special circulation- coronary cerebral, miscellaneous. **Respiratory system** - Mechanics of respiration, Pulmonary function tests, transport of respiratory gases, Neural and Chemical regulation of respiration – hypoxia, cyanosis, and dyspnoea–asphyxia.

Unit III Digestive and Excretory System **10**

Digestive system - General arrangement. Functions & regulations of Salivary digestion, Gastric digestion, Pancreatic digestion and Intestinal digestion. Liver & bile - Absorption, Motility, Deglutition, Vomiting, Defecation. Functions of large intestine, Neurohumoral regulations of alimentary functions, summary. **Excretory System**: Body fluids –distribution, measurement & exchange. Kidney –structure of nephron, mechanism of urine formation, composition of the urine and abnormal constituents, urinary bladder & micturition.

Unit IV Endocrine and Reproductive system **10**

Endocrine System: Hormone mechanism - Negative feed backs, tropic action, permissive action, cellular action, hypothalamic regulation. Hormones, actions, regulations of Thyroid, Adrenal cortex, Adrenal medulla, Parathyroid, Islets of pancreas, Miscellaneous. Common clinical disorders. **Reproductive System**: Male reproductive system – control & regulation. Female reproductive system –uterus, ovaries, menstrual cycle regulation –pregnancy & delivery, breast, family planning.

Unit V Nervous system and special senses **10**

Nervous System – Neuron, Conduction of impulse – synapse, receptor. Sensory organization-pathways and perception. Reflexes –cerebral cortex –functions. Thalamus –Basal ganglia, Cerebellum, Hypothalamus. Autonomic nervous system –motor control of movements, posture and equilibrium. SPECIAL SENSES – (Elementary) Olfaction –Taste –Hearing.

Practicals: **10**

1. Radial pulse tracing
2. Estimation of blood pressure and effect of posture on blood pressure
3. Enumeration of RBC and WBC
4. Differential count
5. Estimation of Hemoglobin
6. Determination of blood group
7. Determination of blood bleeding time and clotting time
8. Determination of erythrocyte sedimentation rate
9. Clinical estimation of Cardiovascular and Respiratory system
10. Clinical assessment of motor and sensory system
11. Clinical assessment of cranial nerves
12. Pain measurement using pain scale

Total Hours 60

Texts Books:

1. G J Tortora, B Derrickson: Principles of anatomy & physiology, 11th edition,
2. A C Guyton: Text book of Medical Physiology, 6th edition, saunders company, Japan, 1981.

Reference Books:

1. R.M. Berne & M.N. Levy, Physiology, 7/e, Mosby Inc., 2017.

Course Outcome:

On the successful completion of the course, students will be able to

CO1: To inspect the structural organization of cell and physiology of blood.

CO2: To elucidate normal growth, response, adaptations and development of different systems.

CO3: To apprehend the function of digestive and excretory system.

CO4: To comprehend the physiological functions of endocrine and reproductive system.

CO5: To discuss Physiological functioning of nervous system and Special senses.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	M	M	L	L	M	H	M	M	L
CO 2	H	M	M	M	M	L	M		M	M	M	M	M	L
CO 3	H	M	M	M			L			L	M	M	M	L
CO 4	H	M	M	L	L	M	M	M	L		M	M	M	L
CO 5	H	H	M	M	M	H	H	H	M	M	H	M	M	M

A

Geometric Optics - I

Semester I
22BOPC03

Hours of Instruction/week: 4+1
No. of Credits: 3

Objectives:

- To gain a thorough knowledge of Stimulus of vision.
- To understand lenses, mirrors, prisms and aberrations.
- To understand the basic properties of the images formed on the retina by the optics of the eye.

Unit I Light **10**

Nature of light – light as electromagnetic oscillation, ideas of sinusoidal oscillations, amplitude and phase, speed of light in vacuum and other media, refractive index. Optical path length, Reversibility of light, rectilinear propagation of light. Wavefronts – spherical, elliptical and plane. Curvature and vergence ray, convergence and divergence in terms of rays and vergence, vergence at a distance Refractive index, its dependence on wavelength.

Unit II Refraction **10**

Snell's Law, Fermat's and Huygen's Principle – Derivation of laws of reflection and refraction. Snell's law from these principles of refraction at a plane surface. Glass slab – displacement without deviation, displacement without dispersion. Total internal reflection, Critical angle, Mirage, optical fibers. Refraction by a spherical surface – sign convention. Introduction to spherical aberration using image formed by a spherical surface of a distance object – sag formula.

Unit III Lens &Vergence **15**

Vergence at a distance formula, effectivity of a refracting surface. Paraxial approximation, derivation of vergence equation. Imaging by a positive and negative powered surface. Lens – 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 and focal lengths. Newton's formula, linear magnification, angular magnification. Thin lens as a special case of thick lens, review of sign convention. Imaging by a thin convex lens and thin concave lens- image properties (real/virtual, erect/inverted, magnified/minified) for various object positions. 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.

Unit IV Mirrors and Nodal Plane **10**

Plane mirrors – height of the mirror, rotation of the mirror. Reflection by a spherical mirror. Paraxial approximation, sign convention, derivation of vergence equation. Imaging by concave and convex mirror. Reflectivity, transmittivity. Nodal Planes.

Unit V Prisms **20**

Prisms – angular dispersion, dispersive power, Abbe's number. Thick prisms – angle of prism, deviation produced by a prism, refractive index of the prism. Definition of crown and flint glasses, materials of high refractive index. Thin prism – definition, definition of Prism diopter, deviation produced by a thin prism, its dependence on refractive index. Prentice's Rule.

Practicals: **10**

1. Construction of pinhole camera
2. Apparent depth
3. Glass slab experiment
4. Construction of kaleidoscope
5. Image formation by Concave and Convex lenses

Total Hours 75

Text Books:

1. Tunnacliffe A. H, Hirst J. G, *Optics*, The association of British Dispensing Opticians, London, U.K., 1990.
2. Keating NM. P, *Geometric, Physical and Visual Optics*, Butterworth- Heinemann, Massachusetts, USA, 2002.
3. Subrahmanyan N, BrijLal, A text book of Optics, S. Chand Co Ltd, New Delhi, India, 2003.

Reference Books:

1. Pedrotti L. S, Pedrotti Sr. F. L, Optics and Vision, Prentice Hall, New Jersey, USA, 1998.
2. Loshin D. S. The Geometric Optics Workbook, Butterworth-Heinemann, Boston, USA, 1991.

Course Outcome:

On the successful completion of the course, students will be able to

CO1: To understand the nature and properties of light.

CO2: To learn the refractive properties of light.

CO3: To gain knowledge on lens and vergence.

CO4: To comprehend about mirrors, reflectivity and nodal planes.

CO5: To elucidate the optics of prisms.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	M	H	M	M	M		M	L	M	H	M	M
CO 2	H	M	M	M	L	L	L		L	L	M	M	M	M
CO 3	H	M	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	M	L	M	M	L	M	M	M	M	M	M	M	M
CO 5	H	M	L	M	M	L	M	L	M	M	H	M	M	M

Physical Optics

Semester I
22BOPC04

Hours of Instruction/week: 5
No. of Credits: 3

Objectives:

- To illustrate the working of various laws related to optical phenomenon.
- To enlighten the students about the various optical parameters such as Interference, Diffraction and Polarisation.
- To demonstrate the advanced principles of physical optics in instruments.

Unit I Nature of light

15

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 Interference & Diffraction

15

Interference phenomena in optics – Constructive interference, Destructive interference. Applications of interference. Coherence- Spatial coherence, Temporal coherence. Fringes, fringe width. Interference in a thin films, interference due to transmitted and reflected light, anti-reflection coating, interferometer. Newton's rings, refractive index of a liquid. Diffraction, diffraction by a circular aperture – qualitative and quantitative. Airy's disc. Resolution of an instrument (telescope, for example), Raleigh's criterion. Double slits, multiple slits, gratings.

Unit III Polarization &Scattering

15

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. Heidinger's Brushes, laser scanning polarimetry, Polaroid Glasses. Scattering, Raleigh's scattering, Tyndall effect. Holography.

Unit IV Fluorescence, Phosphorescence, radiometry and photometry

15

Fluorescence and Phosphorescence – Introduction to Fluorescence and Phosphorescence. Application to Fluorescence in Angiography. 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.

Unit V Laser

15

Basics of lasers – Coherence, spatial and temporal coherence, spontaneous and stimulated emission. Einstein's theory of lasers. Population inversion, Laser pumping. Different types of lasers – gas lasers, Helium- Neon laser, Argon laser.Solid lasers – Ruby laser, semi-conductor lasers. Ophthalmic use of lasers – Excimer laser, LASIK.

Total Hours 75

Text Books:

1. N.Subramanyam, BrijLal and Dr.M.N.Avadhanulu: A text book of Optics, S.Chand& Co. (2019).
2. Keating NM. P, *Geometric, Physical and Visual Optics*, Butterworth- Heinemann, Massachusetts, USA, 2002.
3. Pedrotti L. S, Pedrotti Sr. F. L, *Optics and Vision*, Prentice Hall, New Jersey, USA, 1998.

Reference Books:

1. The Principles of Physical Optics: An Historical and Philosophical Treatment Charles A. Bennett, Wiley, (2008).
2. Physical Optics: Concepts, Optical Elements, and Techniques, Giovanni Giusfredi (2019).

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To recollect the knowledge on various theories and components of light.
CO2: To perceive the effect of interference and diffraction of light on lenses.
CO3: To examine the polarization and scattering properties of light on lenses.
CO4: To evaluate the role of Fluorescence, Phosphorescence, radiometry and photometry in Optometry.
CO5: To scrutinize the role of Lasers in Optometry.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	L	M	L	L	L	M	M	L	M	L
CO 2	H	H	M	M	M	L	M		L	L	L	M	M	M
CO 3	H	H	M	M	M	M	L		L	M	M	M	M	M
CO 4	H	H	M	M	L	L	M	L	M	M	M	M	M	M
CO 5	H	H	H	H	H	M	H		H	H	H	H	H	M

Microbiology

Semester I
22BOPC05

Hours of Instruction/week: 3
No. of Credits: 2

Objectives:

- To gain essential knowledge about the characteristics of bacteria, viruses, fungi and parasites.
- To acquire knowledge of the principles of sterilization.
- To know disinfection process in hospital and ophthalmic practice.

Unit I Introduction to Microbiology and Classification **09**

Introduction to Microbiology, Types of Microorganisms, Physiology of Microorganisms – Nutrition, Enzymes, Metabolism and energy. Classification of bacteria, virus and fungi-morphology and staining.

Unit II Microbial pathogenesis and Immunology **09**

Pathogenesis-Colonization, The development of Infection, the disease process, pathogenicity and virulence and damage to host tissue. Immunology – innate, humoral and defense mechanisms.

Unit III Control of Microbial Growth and Aseptic techniques **09**

Control of Microbial Growth – Antimicrobial methods and Chemotherapy, Culture of microbes, Microbes versus Humans. Sterilization, disinfection and antiseptics.

Unit IV Ocular Bacteriology and Ocular Mycology **09**

Gram positive – Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus, Propioni bacterium, actinomyces, Nocardia. Bacteria including acid fast bacilli – Mycobacterium tuberculosis, Myobacterium leprae. Role of gram positive bacteria in eye and eye diseases. Gram negative Bacteria – Pseudomonas, Haemophiilus, Brucella, Neisseria, Moraxella. Spirochetes – Treponema, Leptospiraceae. Role of gram negative bacteria in eye and eye diseases. Fungi, Yeasts, Filamentous, Dimorphic – Intracellular parasites – Chlamydia. Protozoa – Taxoplasmosis, Acanthamoeba. Helminths- Toxocariasis, Filariasis, Onchocerciasis, Trematodes their role in eye and eye diseases.

Unit V Ocular Virology **09**

Virology, Classification of Viruses in Ocular Disease, Rubella, Adenovirus, Oncogenic Viruses – HPV, HBV, EBV, Retroviruses, HIV.

Total Hours 45

Text Books:

1. BURTON G.R.W: Microbiology for the Health Sciences, third edition, J.P. Lippincott Co., St. Louis, 1988.
2. M J Pelczar (Jr),ECS Chan, NR Krieg : Microbiology, fifth edition, TATA Mc GRAW-HILL Publisher, New Delhi,1993

Reference Books:

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

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To decode the nature of microorganisms.
CO2: To decipher the pathogenesis of microbes and immunological response by the human body.
CO3: To figure out techniques to control the microbial growth and embrace the aseptic techniques to be followed.
CO4: To unravel the behavior of bacteria and fungi in the human eye.
CO5: To inspect the menaces of virus in human eye.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	L	M	M	M	L	L	L	M	M	M	M	M
CO 2	H	L	M	L	M	L	L	L	L	M	M	M	M	M
CO 3	H	M	M	M	H	H	H	M	M	H	H	H	H	H
CO 4	H	M	M	L	H	M	H	M	M	H	H	H	H	H
CO 5	H	H	H		H	H	H	M	M	H	H	H	H	H

Practical I – Physical Optics

Semester I
22BOPC06

Hours of Instruction/week: 4
No of Credits: 2

Objectives:

- To experimentally learn the properties of light
- To verify the properties of light
- To apply the optical principles to learn the physiology of light and vision

List of experiments:

1. Gratings – determination of grating constant using Sodium vapour lamp; determination of wavelengths of light from Mercury vapour lamp.
2. Reflection grating
3. Dispersive power of grating
4. Newton's Ring's - Radius of curvature - Refractive index of lens
5. Newton's Ring's - Refractive index of a Liquid
6. Air wedge experiment thickness of a wire (hair).
7. Refractive index of prism.
8. Diffraction: Single and double slit experiment – Slit width determination.
9. Cauchy's constant and resolving power of prism.

Total Hours 60

Text Books:

1. N.Subramanyam, BrijLal and Dr.M.N.Avadhanulu: A text book of Optics, S.Chand& Co. (2019).
2. Keating NM. P, *Geometric, Physical and Visual Optics*, Butterworth- Heinemann, Massachusetts, USA, 2002.
3. Pedrotti L. S, Pedrotti Sr. F. L, *Optics and Vision*, Prentice Hall, New Jersey, USA, 1998.

Reference Books:

1. The Principles of Physical Optics: An Historical and Philosophical Treatment Charles A. Bennett, Wiley, (2008).
2. Physical Optics: Concepts, Optical Elements, and Techniques, Giovanni Giusfredi (2019).

Course outcome:

On the successful completion of the course, students will be able to

CO1: To apply the optical principles and learn the role of light in seeing.
CO2: To practically examine the polarization properties of light on lenses.
CO3: To practically determine the wavelength of light using mercury vapour lamp
CO4: To determine the refractive index using Newton's ring
CO5: To practically determine the slit width using diffraction.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	L	M	L	L	L	M	M	L	M	L
CO 2	H	H	M	M	M	L	M		L	L	L	M	M	M
CO 3	H	H	M	M	M	M	L		L	M	M	M	M	M
CO 4	H	H	M	M	L	L	M	L	M	M	M	M	M	M
CO 5	H	H	H	H	H	M	H		H	H	H	H	H	M

DSE I: Biochemistry

Semester I
22BOPD01

Hours of Instruction/week: 2+2
No of Credits: 2

Objectives:

- To demonstrate structure, properties and function of various biomolecules.
- To throw light on the basic structure of biomolecules in metabolic pathways.
- To provide the knowledge on the significance of these biomolecules

Unit I Biomolecules

10

Carbohydrates – Classification, Properties and their biological importance. Lipids - Classification and properties of fatty acids, triglycerides, phospholipids, other compound lipids, cholesterol its derivatives and their biological significance. Proteins - Classification and properties of Amino acids. Classification and properties of proteins, plasma proteins, structure of protein, immunoglobulins. Metabolism – role of carbohydrates, proteins and lipids.

Unit II Vitamins, Minerals and Enzymes

10

Vitamins - Classification, functions, source, deficiency manifestations and hypervitaminoses. Minerals - Calcium, Phosphorus, Sodium, Potassium, iron, selenium, iodine, copper – functions, sources, water – electrolyte balance and imbalance. Enzymes - Definition, classification, co-enzymes, factors affecting their action, enzyme inhibition, enzymes of clinical importance, mechanism by which they facilitate biochemical reactions, organ function tests – LFT, kidney function tests,thyroid function tests, adrenal function tests, pancreatic function tests, gastric function tests and tumor markers.

Unit III Hormonal Biochemistry

10

Hormones – communication between cells and tissues, general mechanism of action of hormones, function of steroid hormones, polypeptide hormones, thyroid hormones, parathyroid and pancreas, clinical disorders of hormones. Composition and function of lymph, CSF, ascetic fluid. pleural fluid, synovial fluid. Blood sugar, urea, creatinine and bilirubin significance of their estimation and applications in optometry.

Unit IV Biochemistry of diseases

10

Disorders of metabolism, DM, glycogen storage diseases, plasma lipids and lipoprotein abnormalities, hypercholesterolemia, lipidosis, hypolipoproteinemias. Disorders of nucleic acid metabolism, hypo and hyper urecemia, gout, disorders of erythrocyte metabolism, hemoglobinopathies, thalasemmia and anemias. Inborn errors of metabolism- Phenylketonuria, alkptonuria, albinism, tyronisis, maple syrup urine disease, lesch – nyhan syndrome, sickle cell disease, anemia. Biochemistry of DM, artherolscelrosis, fatty liver, obesity and cancer.

Unit V Ocular Biochemistry

10

Ocular Biochemistry - Various aspects of the eye, viz., tears, cornea, lens, aqueous, vitreous, retina and pigment rhodopsin. Role of Carbohydrates, lipids, proteins, vitamins, minerals, enzymes and hormones and their metabolism in relation eye and eye diseases. Importance of the biochemical constituents in ocular tissues. Rhodopsin, Iodopin and Visual cycle. Application of biochemistry techniques in optometry.

Practicals: **10**

1. Reactions of Monosaccharides, Disaccharaides and Starch – Glucose, Fructose, Galactose.
2. Estimation of Glucose: Detect hypo/hyperglycemia (blood)
3. Lipid profile: estimation of cholesterol, and triglycerol (blood)
4. Urine analysis: Qualitative analysis of urine to detect diseases
5. Estimation of alkaline phosphatase.

Total Hours 60

Text Books:

1. Dr.S.Ramakrishnan: Essentials of Biochemistry & Ocular Biochemistry 1992, Publications Division, Annamalai University. (EBO)

Reference Books:

1. G.Rajagopal &Dr. S.Ramakrishnan: Practical Biochemistry for Medical students. M/s. Orient Longman, Calcutta, 1985.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To acquire knowledge on structure, properties and biological functions of carbohydrates, lipids and proteins.

CO2: To apprehend the significance of Vitamins, mineral and enzymatic functions in human body.

CO3: To collate the uptake and digestion of macronutrients and role of hormones in human body and study the significance of biochemical tests.

CO4: To elucidate the role of biochemical analysis in order to understand the diseases of human body.

CO5: To comprehend the biochemistry of ocular systems.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO
CO 1	H	M	M	M	L	M	L	L	M	L	M	M	M	M
CO 2	H	M	M	M	L	M	L		M	L	M	M	M	M
CO 3	H	M	L	M	M			L	L	M	H	M	M	M
CO 4	H	M	M	M	M	L	L		H	M	H	M	M	M
CO 5	H	M	H	M	M	M	M		M	M	H	H	H	H

English Language for Communication - II

Semester II
22BLEN02

Hours of Instruction/week: 3
No of Credits: 3

Objectives:

- To become familiar with the nuances of academic writing
- To produce short and simple connected texts on familiar topics.
- To communicate effectively and appropriately in real-life situations

Unit I Communicate: Outside the Class **09**

Patterns of Language-Modal Verbs
Speaking-Useful Everyday Expressions
Making Language Work – Expressions to Indicate Speculations and Making Inferences

Unit II Communicate: At the Post Office **09**

Patterns of Language-Phrasal Verbs/ Idioms Speaking
Distinguishing between pairs of expression
Making Language Work-Clipping , Forming Sentences,
Converting SMS into Normal Script

Unit III Contemplate: How to Win **09**

Writing: completing a story, dialogue

Unit IV Contemplate: View Points **09**

Speaking: Agreeing/Disagreeing, expressing oneself

Unit V Contemplate: Snakes and Ladders **09**

Contemplate: Your Self

Speaking: Making comparisons Writing: Preparing lists

Assignments and Activities in Class:

(a) Model question paper in the text book.
(b) Vocabulary building, analyzing poems and listening activities (from CD)

Total Hours 45

Text Books:

1. Krishnaswamy N,sriraman T,Creatinve Englishfor Communication,2 nded. Haryana, Macmillan, 2012.

Reference Books:

1. Das, Bikram K,Functional Grammar and Spoken and Written communication in English (A Short friendly Edition),New Delhi: Orient Black Swan,2010.
2. Mudbhatkel, Maya and Saraswathi, English for Competitive Examinations, Emerald Publishers, 2003.
3. Rajeevan, Geetha and Kiranmani Dutt,Basic Communication Skills, New Delhi: Foundation Books, 2010.
4. Rajeevan K and Radhakrishna Pillai, Spoken English For You,Chennai:Emerald Publishers, 2014

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: Use increased vocabulary in their writing
CO2: Use expressions in appropriate context
CO3: Use the English language accurately and appropriately for different purposes
CO4: Understand how phrasal verbs, idioms enrich language
CO5: Demonstrate effective writing skills.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	M	M	L	M	L	L	M	L	M	M	M	M
CO 2	H	M	M	M	L	M	L		M	L	M	M	M	M
CO 3	H	M	L	M	M			L	L	M	H	M	M	M
CO 4	H	M	M	M	M	L	L		H	M	H	M	M	M
CO 5	H	M	H	M	M	M	M		M	M	H	H	H	H

Ocular Anatomy

Semester II
22BOPC07
Hours of Instruction/week: 4
No of Credits: 3

Objectives:

- To comprehend the gross, functional and applied anatomy of various structures in the eye and adnexa.
- To comprehend the basic structure and connections between the various parts of the central nervous system and the eye.
- To understand the basic principles of ocular embryology.

Unit I Ocular Embryology **12**

Formation of optic vesicle and optic stalk, formation of lens vesicle, formation of optic cup, changes in associated mesoderm, development of various structure of eye ball – retina, optic nerve, crystalline lens, cornea, sclera, choroid, ciliary body, iris, vitreous. Development of accessory structures of eyeball – eyelids, lacrimal apparatus, extra-ocular muscles, orbit. Milestones in the development of the eye.

Unit II Orbit & Eyelids **12**

Bony orbit - Size, shape and relations, walls of the orbit, Base of the orbit, Apex of orbit. Orbital fascia – Fascial bulbi, Fascial sheaths of extraocular muscles, intermuscular septa. Spaces of orbit - Orbit fat and reticular tissue, apertures at the base of orbit. Contents of the orbit - Orbital nerve, oculomotor, Trochlear, Abducent, Trigeminal, facial nerves - their functional components, course and distribution, clinically applied aspects. **Lids** - Structures of the lids, Skin, Subcutaneous Areolar Layer, Layer of Striated muscle, Sub muscular Areolar Tissue, Fibrous Layer, Conjunctiva. Glands of the Lids- Meibomian Glands, Glands of Zeis and Glands of Moll. Blood Supply of the Lids, Lymphatic Drainage of the Lids, Nerve Supply of the Lids.

Unit III Lacrimal Apparatus & Conjunctiva **12**

The lacrimal apparatus - Lacrimal gland, palpebral part, ducts of lacrimal gland, structure of the lacrimal gland, blood supply & nerve supply of the lacrimal gland, lacrimal passages. Anatomy of the Ocular Adnexa & glands. **Conjunctiva** - Palpebral Conjunctiva, Bulbar Conjunctiva, Conjunctival Fornix, Microscopic Structure of the conjunctiva- Epithelium, Substantia Propria. Conjunctival Glands - Krause's Glands, Wofring's Glands, Henley's Glands, Manz Glands. Blood Supply of the Conjunctiva, Nerve Supply of the Conjunctiva, Caruncle, Plica, Semilunaris.

Unit IV Cornea and the Anterior Segment **12**

Cornea - Layers & peculiarities, Blood supply and nerve supply of cornea, Corneal Transparency. **Lens** - Zonules. Structure of lens - capsule, Anterior Epithelium, lens fibers (structured & zonal arrangement), Ciliary zonules - structure, gross appearance, Arrangement of zonules fibers. Uveal Tract & its vascular supply. Macroscopic & Microscopic appearance of Iris, Ciliary body and Choroid. Blood supply to uveal structure- Short & Long Posterior artery and Anterior Artery, Venous drainage, anterior chamber and its angle- angle of the anterior chamber. Trabecular meshwork. Canal of Schlemm, Schwalbe's line. Drainage of aqueous humor.

Unit V Anatomy of the Posterior Segment **12**

Vitreous- main masses of vitreous, base of the vitreous. Hyaloidean vitreous. Vitreous cells. **Sclera** – Anterior, posterior & middle apertures. Episclera, Sclera proper, Lamina fuscia. Blood supply of the sclera. Nerve supply of the sclera. **Retina** - vascular supply, Gross anatomy, Microscopic structure of fovea centralize, Blood retinal barrier. **Optic Nerve** - Anatomy of optic nerve, Optic Chaisma optic tracts, Lateral Geniculate body, optic radicalism, visual cortex, Arrangement of nerve fibers, Blood supply of visual pathways (Arterial circle of willis & its branches). **The Ocular motor system** - Extraocular muscles, nerve supply, motor nuclei, supra nuclear motor centers. The pupillary &ciliary muscle - Anatomy of sphincter & Dilator muscle. **Ciliary muscle** – Anatomy, types, the nerve supply of the eye ball.

Total Hours 60

Text Books:

1. Snell RS, Lemp MA. Clinical anatomy of the eye. John Wiley & Sons; 2013.
2. A Remington: Clinical Anatomy of the Visual System, Second edition, Elsevier Butterworth Heinemann, Missouri, USA, 2005.

Reference Books:

1. AK Khurana, Indu Khurana: Anatomy and Physiology of Eye, Second edition, CBS Publishers, New Delhi, 2006.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To investigate the growth of human eye.
CO2: To apprehend the anatomy of orbit.
CO3: To analyze the anatomy of cornea and the anterior segment of eye.
CO4: To look into the anatomy of posterior segment of the eye.
CO5: To observe the anatomy of conjunctiva and lacrimal apparatus.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	M	L	M	M	M	L	M	M	H	H	H	H
CO 2	H	M	M	L	H	M	M	L	M	M	H	H	H	H
CO 3	H	M	M	L	H	M	H	M	M	M	H	H	H	H
CO 4	H	M	M	L	H	M	H	M	M	M	H	H	H	H
CO 5	H	M	M	L	H	M	H	M	M	M	H	H	H	H

Ocular Physiology

Semester II
22BOPC08

Hours of Instruction/week: 3+2
No of Credits: 3

Objectives:

- To explain the normal functioning of all the structures of the eye and their interactions.
- To elucidate the physiological aspects of normal growth and development of the eye.
- To understand the phenomenon of vision and physiological principles of underlying pathogenesis and treatment of disease of the eye.

Unit I Tear film, Eyelid and Cornea **15**

Protective Mechanism of the eye: Blinking – muscles of lid opening & lid closure (orbicularis oculi, levator palpebrae, Muller's muscle, blinking reflexes. Lacrimation – Lacrimal glands, Pre corneal tear film, Chemistry of lacrimal secretion tear film & Tear film dynamics (secretion of tear, formation of tear), retention & redistribution of tear, displacement phenomena, evaporation from tear film, drying & breakup of tear film, dynamic events during blinking, elimination of tear. **Cornea**- Brief idea about ultra & histological structure of cornea, Corneal transparency & hydration, Regulation of corneal transparency &hydration. Corneal vascularization. Maurice theory& Goldman's theory. **Uveal tissue**- Brief idea about uvea, Uveal meshwork, Uveo-scleral drainage, Schlemm's canal switch. Formation of Aqueous humour, Drainage & circulation of Aqueous Humor. Rates of production & flow. Functions of Aqueous humour.

Unit II Extraocular muscles and eye movements. **10**

Extra ocular muscles - their function & nerve supply. Mechanics of actions of extra ocular muscles -cross sectional area of muscle, length of muscle. Arc of contact, muscle plane, Muscle axis of rotation. Physiology of ocular movement – Basic Kinematics, (position of gaze, Fick's axes). Ocular Movement (monocular and Binocular). Supra nuclear control of eye movements. **Ocular movements: Monocular Movements** - Adduction, Abduction, Supraduction, Infraduction, Incycloduction, Excycloduction. **Binocular Movements**: Versions- (saccadic & pursuit movement, position maintenance movements, stabilization movements & their characteristics). Vergences – (Convergence, divergence, vertical vergence).

Unit III Pupils, Accommodation and Intraocular Pressure **10**

Pupil: Normal pupil, Physiological changes in pupil size – Isocoria, Pupillary unrest, Hippies. Pupillary reflex – Light reflex, Near reflex, Darkness reflex, Psycho sensory reflex, Lid closure reflex. Intraocular pressure - Features of normal IOP, Factors influencing the IOP, Control of IOP, Measurement of IOP. **Accommodation**- Far point, near point, range &amplitude of Accommodation. Mechanism of accommodation – Increased tension theory, Relaxation theory, Role of lens capsule, Gullstrand mechanical model of accommodation. Stimulus for accommodation. Ocular changes in accommodation. Changes in accommodation with age (Presbyopia). Nervous mechanism for accommodation.

Unit IV Lens, Vitreous, Retina, Optic nerve and Ocular circulation **15**

Lens- Basic idea about human lens, Function of lens, Lens transparency, Lens culture, Changes in ageing lens. **Vitreous** - Composition & distribution of vitreous humour, Physiology & function of vitreous humour, Optical role of vitreous humour. **Retina-** Retinal structure, layers of retina, brief idea about rod &cones, Organization of retina, function of retina. **Optic Nerve** - Physiology of optic nerve. **Ocular Circulation** - Vascular structure of the eye, ocular circulation, blood-ocular barrier (Blood-retinal, blood Vitreous & blood aqueous barrier). Regulation of ocular circulation.

Unit V Physiology and Neurophysiology of Vision **15**

Visual perception –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. **Physiology of vision** - Visual acuity, Visual angle, Components of Visual acuity (Minimum visible, Resolution, Recognition Hyperacidity), Factors affecting, Measurement of visual acuity. Contrast Sensitivity – Types (spatial & Temporal contrast sensitivity), Neural Mechanism, Measurement of contrast sensitivity (Arden gratings , Cambridge low contest gratings, Pelli – Robson chart). Light & Dark adaptation - Dark adaptation curve, Mechanism of dark adaptation, Factors influencing dark adaptation, Time course of light adaptation, Mechanism of light adaptation, Rod vs. cone light adaptation. Purkinje shift of spectral sensitivity. Binocular vision - Grades of binocular vision (simultaneous, fusion & stereopsis), Advantages of binocular vision, visual direction &horopter, Binocular fusion, Dichoptic stimulation , Depth perception, Integration of motor & sensory system. Electro diagnostic tests - ERG, EOG, VER. Color vision- Physiological, Photochemical & neurological basis of color vision. Electrophysiology of color vision. Granit's modulator and dominator theory, Purkinje phenomenon. Young-Helmholtz theory. Types of color defects, Color blindness. Neural analysis Geneculate cortex: Structure of geneculate cortex. Electrophysiology. Projection – retinal projection. Detail idea about visual cortex & function of visual cortex.

Practicals: **10**

1. External examination of the eye – assessment of eyelids and lashes
2. Examination of cornea, conjunctiva and lens using torch light
3. Measurement of blink rate
4. Measurement of Palpebral fissure height (Horizontal and Vertical)
5. Measurement of Visible iris diameter (Horizontal and vertical)
6. Ocular motility test
7. Test action of LPS
8. Test for Lacrimation, ROPLAS
9. Syringing
10. Observation of tear film, puncta

11. Test corneal Sensitivity
12. IOP – Finger tension
13. Assessment of iris
14. Assessment of pupillary reflexes and pupillary diameter using IPD ruler and torch light.
15. Vision assessment, Contrast sensitivity assessment, Color Vision, Stereopsis.

Total Hours 75

Text books:

1. AK Khurana, Indu Khurana: Anatomy and Physiology of Eye, Second edition, CBS Publishers, New Delhi, 2006.

Reference books:

1. R D Ravindran: Physiology of the eye ,Aravind eye hospitals, Pondicherry,2001.
2. PL Kaufman, A Alm: Alder's Physiology of the eye clinical application, 10th edition, Mosby,2002.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To inspect the physiology of cornea, dynamics of aqueous humor and eyelid and tear film physiology.
CO2: To interpret physiology of lens, vitreous humor, retina, optic nerve and ocular circulation.
CO3: To investigate the physiology of extra ocular muscles and eye movements
CO4: To examine the physiology of pupils, accommodation and intraocular pressure
CO5: To scrutinize the physiology and neurophysiology of vision

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	M	L	M	M	M	L	M	M	H	H	H	H
CO 2	H	M	M	L	H	M	M	L	M	M	H	H	H	H
CO 3	H	M	M	L	H	M	H	M	M	M	H	H	H	H
CO 4	H	M	M	L	H	M	H	M	M	M	H	H	H	H
CO 5	H	M	M	L	H	M	H	M	M	M	H	H	H	H

Geometric Optics - II

Semester II **Hours of Instruction/week: 4**
22BOPC09 **No of Credits: 3**

Objectives:

- To impart knowledge on telescopes and microscopes.
- To understand the laser optics phenomenon in detail.
- To gain knowledge of errors of refraction in GSE

Unit I Cylindrical lenses **15**

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 Sphero cylindrical lens notations – plus/minus cylinder form, cross cylinder/meridian form, transformations between them.

Unit II Fields, Apertures & Pupil **10**

Field stops and apertures, entrance and exit pupils. Apertures and defocus blur. Receiver/detector diameter, depth of focus, depth of field.

Unit III Aberrations **12**

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 IV Telescopes & Microscopes **11**

Telescopes – Keplerian, Galilean and Newtonian. Position of cardinal points, entrance and exit pupils, magnifications, advantages and disadvantages Microscopes – magnification, tube length.

Unit V Gullstrand's Schematic Eye (GSE) **12**

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, chromatic aberrations and coma. 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.

Total Hours 60

Text Books:

1. Tunnacliffe A. H, Hirst J. G, Optics, The association of British Dispensing Opticians, London, U.K., 1990.
2. Keating NM. P, Geometric, Physical and Visual Optics, Butterworth- Heinemann, Massachusetts, USA, 2002.

Reference Books:

1. Subrahmanyan N, BrijLal, A text book of Optics, S. Chand Co Ltd, New Delhi, India, 2003.
2. Pedrotti L. S, Pedrotti Sr. F. L, Optics and Vision, Prentice Hall, New Jersey, USA, 1998.
3. Loshin D. S. The Geometric Optics Workbook, Butterworth-Heinemann, Boston, USA, 1991.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To apprehend the nature of cylindrical lenses and its relation to eye.
CO2: To inspect the effects of pupil, apertures and field stops.
CO3: To scrutinize aberrations and its impact on our eyes.
CO4: To resolve telescopes and microscopes.
CO5: To decode Gullstrand's schematic eyes.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	M	H	M	H	H	M	H	H	H
CO 2	H	H	M	M	L		L		L	L	L	M	M	M
CO 3	H	H	M	M	M	L	L		L	M	M	M	M	M
CO 4	H	H	M	M	H	M	M	L	M	M	M	M	M	M
CO 5	H	H	M	H	H	M	M	L	M	H	H	M	H	M

Nutrition

Semester II **Hours of Instruction/week: 3**
22BOPC10 **No of Credits: 2**

Objectives:

- To know the concept of nutrition and its assessment.
- To gain knowledge in the planning and preparation of therapeutic diets.
- To understand the planning, selection and preparation of foods during health and deficiency conditions.

Unit I Introduction to Nutrition and Energy **07**

History of Nutrition - Nutrition as a science, Food groups, RDA, assessment of nutritional status. Measurements of energy and value of food, Energy expenditure, Total energy/calorie requirement for different age groups and diseases, Satiety value. Energy imbalance- obesity, starvation. Limitations of the daily food guide. Digestion, absorption and transport of Food.

Unit II Proteins, fats, Carbohydrates **08**

Proteins - Sources and functions, Essential and non- essential amino- acids, Incomplete and complete proteins, Supplementary foods, PEM and the eye, Nitrogen balance, Changes in protein requirement. **Fats** - Sources and functions, Essential fatty acids, Excess and deficiency, Lipids and the eye, Hyperlipidemia, heart diseases, atherosclerosis. **Carbohydrates** - Sources, functions, excess/deficiency, relationship with eyes. Digestion of Proteins, carbohydrates & lipids.

Unit III Vitamins, Minerals, Water and Fiber **12**

Vitamins - General functions and food sources, Vitamin deficiencies and associated eye disorders with particular emphasis to Vitamin A, Promoting sound habits in pregnancy, lactation and infancy, Nutrient with antioxidant, Properties. **Minerals** -General functions and sources, Macro and micro minerals associated with the eye, Deficiencies and excess – ophthalmic complications (e.g. iron, calcium, iodine etc.).**Water**- Importance, functions, requirements. **Fiber**- definition, classification, sources and role of fiber in human nutrition and disease.

Unit IV Concept of Diet Therapy **10**

Classification, purpose and principles of therapeutic diets, modification of normal diets. Obesity and underweight - Etiological factors, grade of malnutrition, complications and diet modification. Definition, causes, signs and symptoms, diet modification for diabetes mellitus. Febrile conditions - Typhoid, Tuberculosis, Malaria, Pneumonia, Influenza. Gastrointestinal disorders- Peptic ulcer, Diarrhea, Dysentery, Constipation. Liver and kidney diseases- Jaundice, Hepatitis, Cirrhosis, Hepatic coma, Acute and chronic renal failure, Dialysis. Cardiovascular disease- Atherosclerosis, Hypertension, diet and eye.

Unit V Antioxidants & Miscellaneous and Nutrition for different age groups **08**

Antioxidant - Lutein, xeamanthin, lycopene, Monosodium Glutamate, aspartame and their role in vision and ageing. **Miscellaneous -** Measles and associated eye disorders, low birth weight. Food and nutritional requirements for infants – nutritional importance of breast feeding, preschool and school going children, adolescent, adult, elderly, pregnant and lactating mothers and the impact of nutritional deficiency in eye.

Total Hours 45

Text Books:

1. M Swaminathan: Hand book of Food and Nutrition, fifth edition, Bangalore printing & publishing Co.Ltd, Bangalore,2004

Reference Books:

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

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To comprehend the concept of nutrition and energy.
CO2: To equip on the sources, function of proteins, fats and carbohydrates and their role in eye.
CO3: To gain knowledge on the role of vitamins, minerals, water and fiber in digestion and absorption of food and its impact on eyes.
CO4: To decipher the concept of diet and effectively plan a diet.
CO5: To understand the nutritional requirements for different age groups and the impact of nutritional deficiencies in eye.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO
CO 1	H	M	M	M	L	M	L	L	L	L	M	M	M	M
CO 2	H	M	M	M	L	M	M	L	L	L	M	H	H	M
CO 3	H	M	M	M	M	M	L	L	L	M	H	H	H	M
CO 4	H	M	L	M	M	L		L	L	M	H	M	M	M
CO 5	H	M	H	M	M	H	L	M	M	M	H	H	M	M

Practical II - Geometric Optics

Semester II **Hours of Instruction/week: 3**
22BOPC11 **No of Credits: 2**

Objectives:

- To enhance the students with practical knowledge of various procedures.
- To gain the skills about various procedures involved in geometrical optics.
- To apply the geometrical aspects of light to understand the physiology of eye

List of experiments:

1. Thick Prism – determination of prism angle and dispersive power; calculation of the refractive index.
2. Thin Prism – measurement of deviation; calculation of the prism diopter.
3. Apical angle of a prism
4. Dispersive power of prism
5. Refractive index of prism
6. Image formation by spherical mirrors.
7. Convex lens - power determination using lens gauge, power determination using distant object method; power determination using the vergence formula.
8. Concave lens – in combination with a convex lens – power determination.
9. 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.
10. 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 orientations.

Total Hours 45

Text Books:

1. Tunnacliffe A. H, Hirst J. G, *Optics*, The association of British Dispensing Opticians, London, U.K., 1990.
2. Keating NM. P, *Geometric, Physical and Visual Optics*, Butterworth- Heinemann, Massachusetts, USA, 2002.
3. Subrahmanyan N, BrijLal, A text book of Optics, S. Chand Co Ltd, New Delhi, India, 2003.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To investigate geometric properties of light in the role of vision.
CO2: To gain practical knowledge on image formation by spherical mirrors.
CO3: To construct tabletop microscopes and telescopes.
CO4: To determine the prism angle and dispersive power using thick and thin prisms.
CO5: To determine the magnifying power of a simple and a compound microscope.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO
CO 1	H	H	H	M	M	M	H	M	H	H	M	H	H	H
CO 2	H	H	M	M	L		L		L	L	L	M	M	M
CO 3	H	H	M	M	M	L	L		L	M	M	M	M	M
CO 4	H	H	M	M	H	M	M	L	M	M	M	M	M	M
CO 5	H	H	M	H	H	M	M	L	M	H	H	M	H	M

DSE II: Digital Health

Semester II **Hours of Instruction/Week: 2+2**
22BOPD02 **No of Credits: 2**

Objectives:

- To know about the basics of Digital Health.
- To know about AI use in the healthcare systems.
- To know about3D products in healthcare system.

Unit I Digital Health **12**

Introduction of Digital Health – Vision - Benefits of Digital Health – Digital Health Initiatives – National Digital HealthMission – Ecosystem – Architecture – Applications of Digital Health - Learning Health System –Characteristics of Learning Health Care System

Unit II Digital Health CareProducts **12**

Categories of Digital Health Products and Services - Wearable Fitness Tracker — Smart health watches – Wearable ECG Monitors – Wearable Blood Pressure Monitor – Wearable Biosensor – mHealth –Telehealth – Telemedicine -Difference between mHealth vs telehealth -Difference between Telehealth vs Telemedicine

Unit III ML and DL in Healthcare **12**

About machine Learning – Benefits of ML in Healthcare – Cognitive Computing – Trend of ML in Medical Health – Applications of ML in Pharma and Medicine – Applications of ML in Healthcare –Big Data – Benefits of Big Data in Healthcare – Features of Big Data in Healthcare – Methods for analysing Big Data in Healthcare - Applications of Big Data in Healthcare - Introduction on Deep Learning –Deep Learning Algorithms– Deep Learning in Clinical Image Analysis.

Unit IV Artificial Intelligence in Healthcare **12**

AI-assisted Robotic surgery – Virtual nursing assistant – Aid Clinical judgment or diagnosis – Administrative task – Image Analysis–Develop Medicines – Analyses Unstructured Data – Forecast Kidney Disease – Contributes to Cancer Research and Treatment – Supports Health Equity – AI in Neuroscience – AI in Thoracic Surgery – AI in Cardiac Management.

Unit V Robotics & 3D Printing in Healthcare **12**

Role of Robots in Healthcare – Benefits of robots in Healthcare - Types of Robots in Healthcare – Surgical Robots –Exoskeletons – Care Robots – Hospital Robots –3D Printing for Healthcare – Preoperative planning – Customized Surgery – Designing medical devices – Improving surgical instruments – Creating Protheses – 3D Printed implants – 3D Digital Dentistry – Streamlining drug administration

Total Hours 60

Reference Books:

1. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, GiaNhu Nguyen, (2018). "Emerging Technologies for Health and Medicine - Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0", ISBN 978-1-119-50981-3
2. Thomas-Vazquez, Daniel & Singh, Deepti&Hatamleh, Muhanad&Tripathi, Anuj&Vishnoi, Tanushree& Bhat, Sumrita& Thompson, Andrew & Jason, Jeremy & Kim, Keekyoung&Gleadall, Andy & Ruiz, Laura. (2019). "3D Printing in Medicine and Surgery", Woodhead Publishing Series in Medicine, ISBN 978-0-85709-233-5.

Website links:

1. https://www.ncbi.nlm.nih.gov/books/NBK470260/
2. https://www.insiderintelligence.com/insights/wearable-technology-healthcare-medical-devices/
3. https://www.singlecare.com/blog/telehealth-vs-telemedicine/
4. https://www.mobihealthnews.com/news/contributed-top-10-use-cases-ai-healthcare
5. https://www.researchgate.net/publication/330724271_Big_Data_in_Health_Care_Applications_and_Challenges
6. https://www.mobihealthnews.com/news/contributed-top-8-healthcare-uses-3d-printing
7. https://amfg.ai/2019/08/30/3d-printing-in-healthcare-where-are-we-in-2019/

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: Get familiar with Digital Health.

CO2: Understand the working nature of the Wearable Devices used in Digital Health.

CO3: Knowledge on Machine Learning techniques used in healthcare system.

CO4: Knowledge on AI embedded Healthcare system.

CO5: Get familiar with 3D Model Products and Robots in healthcare systems.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	M	M	H	-	H	H	-	M	-	-	-	M	H	M
CO2	M	M	H	-	H	H	-	M	-	-	-	H	H	H
CO3	M	H	H	H	H	H	M	M	-	M	-	M	H	H
CO4	M	H	H	H	H	H	M	M	-	M	-	M	H	H
CO5	M	M	H	H	H	H	-	M	-	M	-	M	H	H

Optometric Optics – I

Semester III **Hours of Instruction/week: 3**
22BOPC12 **No of Credits: 2**

Objectives:

- To identify different forms of lenses.
- To impart knowledge on manufacturing process of lenses.
- To understand safety standards of lenses.

Unit I Lenses **09**

Introduction – Light, Mirror, Reflection, Refraction and Absorption. Lenses – Definition, units, terminology used to describe, form of lenses. Lens shape, size and types i.e. spherical, cylindrical and Sphero-cylindrical lenses.

Unit II Manufacturing of lenses **09**

Raw materials – History and General Outline, Manufacturing of Ophthalmic Blanks – Glass & Plastics, Terminology used in Lens Workshops, Surfacing process from Blanks to lenses.Glazing & edging (manual & automatic).

Unit III Lens Materials and its properties **09**

Definition, Materials,Types and Characteristics of Glass, Plastics, Polycarbonate, Trivex. Lens. Properties - Refractive index, specific gravity, UV cut off, impact resistance – include drop ball test, Abbe value, and Center thickness.

Unit IV Lens Safety Standards and Lens Faults **09**

Lens quality,Faults in lens material,Faults on lens surface. Best form of lenses & Safety standards for Ophthalmic lenses - FDA, ANSI, ISI, Others.

Unit V Vertex Calculations & Transpositions **09**

Vertex Calculations:Vertex distance and vertex power, Effectivity calculations.Spherometer & Sag formula, Edge thickness calculations. Transpositions – Simple Transposition, Toric Transposition and Spherical equivalent.

Total Hours 45

Text books:

1. Jalie M: The principles of Ophthalmic Lenses, The Association of Dispensing Opticians, London, 1994.
2. David Wilson: Practical Optical Dispensing, OTEN- DE, NSW TAFE Commission,1999.

Reference books:

1. C V Brooks, IM Borish: System for Ophthalmic Dispensing, Second edition, Butterworth-Heinemann, USA, 1996.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To discuss on forms and types of lenses.
CO2: To know the manufacturing process of lenses.
CO3: To gain knowledge on lens materials and its properties.
CO4: To acquire knowledge on safety standards of lenses.
CO5: To learn transposition and its types in detail

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	M	H	M	H	H	H	H	H	H
CO 2	H	H	M	M	H		M		M	L	M	M	H	M
CO 3	H	H	M	M	M	L	M	M	M	M	M	M	H	M
CO 4	H	H	M	M	H	M	H	H	H	M	M	H	H	M
CO 5	H	H	M	H	M	M	M	M	H	H	H	H	H	M

Visual Optics – I

Semester III **Hours of Instruction/week: 3**
22BOPC13 **No of Credits: 3**

Objectives:

- To understand the fundamentals of optical components of the eye.
- To gain knowledge on visual acuity measurement.
- To impart knowledge on causes of refractive errors and its types.

Unit I Review of Geometric Optics **09**

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 applications.

Unit II Optics of Ocular Structures **09**

Cornea and aqueous, Crystalline lens, Vitreous, Schematic and reduced eye

Unit III Measurement of the optical constants of the eye **09**

Corneal curvature and thickness, Keratometry, Curvature of the lens and Opthalmophakometry, Axial and axis of the eye.

Unit IV Basic Aspects of Vision. **09**

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

Unit V Refractive anomalies and their causes **09**

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.

Total Hours 45

Text Books:

1. Bennett &Rabbetts: Clinical visual Optics
2. David O Michaels: Visual Optics & Refraction (DOM)

Reference Books:

1. M P Keating: Geometric, Physical and Visual optics, 2nd edition, Butterworth-Heinemann, USA, 2002
2. T Grosvenor: Primary Care Optometry,4th edition, Butterworth – heinneman,USA,2002
3. WJ Benjamin: Borish's clinical refraction,2nd edition, Butterworth Heinemann, Missouri, USA,2006.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To review geometrical optics and inspect its role in seeing and vision.
CO2: To acquire knowledge on optics of components of eye.
CO3: To compute the optical constants.
CO4: To comprehend the basic aspects of vision.
CO5: To inspect the refractive anomalies of the eye and their causes.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	M	M	M	H	H	H	H	H	H
CO 2	H	H	M	M	H		H	M	H	M	H	H	H	M
CO 3	H	H	M	M	M	L	M	M	M	M	M	M	H	M
CO 4	H	H	M	M	H	M	H	H	H	M	M	H	H	M
CO 5	H	H	M	H	H	M	H	M	H	H	H	H	H	H

Optometric Instruments

Semester III **Hours of Instruction/week: 3**
22BOPC14 **No of Credits: 3**

Objectives:

- To gain theoretical and basic practical knowledge in handling the Optometric & Ophthalmic instruments.
- To know the purpose, set-up and devices required for the test.
- To demonstrate various Orthoptic and Ophthalmic instruments and Screening devices.

Unit I Refractive Instrument **10**

Optotypes and Modulation Transfer Function [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 cuity test, Vision analyzer, Pupilometer, Potential Acuity Meter, Abberometer.

Unit II Ophthalmoscopes and related devices **08**

Design of Ophthalmoscopes – illumination/viewing, Ophthalmoscope disc, Filters for ophthalmoscopy, Indirect ophthalmoscopes and uses of the ophthalmoscope in special cases.

Unit III Anterior Segment Instruments **09**

Lensometer, lens gauge or clock, Keratometer and Corneal topography, Refractionometer. **Slit lamp** - Slit lamp systems, Viewing microscope systems, Scanning laser devices, Slit lamp accessories, Mechanical design in instruments. **Tonometer** – principles, types of tonometers, standardization, uses and interpretation of tonometers.

Unit IV Ancillary Assessment Instrument **09**

Color Vision Testing Devices, Fields of Vision Screening Devices –Perimeter and the visual field, Illumination of field-testing instruments, Projection perimeters, Screening devices for field defects, Results of field examination, Vision screeners – principles, details, analysis of screener results, Bowl perimeters, Goldmann and Humphery Visual Field Analyzer.

Unit V Imaging **09**

Ophthalmic Ultrasonography - Biometry/Ultrasound/'A' Scan/'B' Scan/UBM.
Retina and **Electro diagnostics** - ERG, VEP, EOG, OCT, FFA, ICG. Glaucoma diagnostics, HRT, GDX, Microperimetry. Cornea Diagnostics - OCTA, Topo, Pentacam, Specular microscopy, Confocal microscopy.

Total Hours 45

Text Books:

1. David Henson: Optometric Instrumentations, Butterworth- Heinnemann, UK, 1991
2. T Grosvenor: Primary Care Optometry, 5th edition, Butterworth – Heinneman, USA, 2007.

Reference Books:

1. P R Yoder: Mounting Optics in Optical Instruments, SPIE Society of Photo-Optical Instrumentation, 2002.
2. G Smith, D A. Atchison: The Eye and Visual Optical Instruments, Cambridge University Press, 1997.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To understand various vision testing and screening devices and its principles.
CO2: To know about the design, features and advantages of ophthalmoscope and related devices.
CO3: To know the types, principle and procedures of slit lamp and tonometers.
CO4: To gain knowledge in ultrasonography and visual field analyser.
CO5: To understand electro diagnostic procedures in detail.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	H	H	M	H	H	H	H	H	H
CO 2	H	H	M	M	H	H	H	M	H	M	H	H	H	H
CO 3	H	H	M	M	M	H	H	M	M	M	M	M	H	H
CO 4	H	H	M	M	H	H	H	H	H	M	M	H	H	H
CO 5	H	H	M	H	H	H	H	M	H	H	H	H	H	H

Ocular Diseases - I

Semester III **Hours of Instruction/week: 5**
22BOPC15 **No of Credits: 4**

Objectives:

- To understand the introduction of pathology and pathology related to Ocular diseases.
- To impart knowledge on anatomy, causes, signs, symptoms, diffential diagnosis and treatment of various Ocular conditions.
- To acquire knowledge on diagnostic approach and management of Ocular diseases.

Unit I Orbit and Eyelids **15**

Orbit- Review of 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 trauma. **Eyelids** - Review of Anatomy, Congenital anomalies - Ptosis, Coloboma, Epicanthus, Distichiasis, Cryptophthalmos. Oedema of the eyelids - Inflammatory, Solid, Passive oedema. 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.

Unit II Conjunctiva and Lacrimal system **15**

Conjunctiva - Review of Anatomy, Inflammations of conjunctiva - bacterial, chlamydial, viral, Allergic and Granulomatous conjunctivitis. Degenerative conditions - Pinguecula, Pterygium, Concretions. Symptomatic conditions - Hyperaemia, Chemosis, Ecchymosis, Xerosis, Discoloration. Cysts and Tumors. **Lacrimal system** - Review of Anatomy, TearFilm, The Dry Eye (Sjogren's Syndrome).The watering eye - Etiology, clinical evaluation. Dacryocystitis, Swelling of the Lacrimal gland – Dacryoadenitis.

Unit III Cornea **15**

Review of Anatomy and Physiology, Congenital Anomalies - Megalocornea, Microcornea, Cornea plana, Congenital cloudy cornea. Inflammations of the cornea - 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 vascularization, Penetrating Keratoplasty.

Unit IV Uvea and Sclera **15**

Uveal Tract - Review of Anatomy, Classification of uveitis, Etiology, Pathology, Anterior Uveitis, Posterior Uveitis, Purulent Uveitis, Endophthalmitis, Panophthalmitis, Pars Planitis, Tumors of Uveal tract - Melanoma. Clinical examination of Uveitis. **Sclera** - Review of Anatomy, Episcleritis and scleritis. Clinical examination of Scleritis.

Unit V Lens **15**

Review of Anatomy and Physiology, Clinical examination, Classification of cataract. Congenital and Developmental cataract. Acquired - Senile, Traumatic, Complicated, Metabolic, Electric, Radiational, Toxic cataract. Morphological classification - Capsular, Sub capsular, Cortical, Supranuclear, Nuclear and Polar cataract. Complications of cataract surgery, Displacement of lens - Subluxation, Displacement. Lenscoloboma, Lenticonus, Microsperophakia. Management of cataract - Non surgical and surgical measures, preoperative evaluation, Types of surgeries.

Total Hours 75

Text Books:

1. Jack J. Kanski: Clinical Ophthalmology, Butterworths, 2nd Ed., 1989.
2. Stephen J. Miller: Parsons Diseases of the Eye, 18th edition, Churchill Livingstone, 1990.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To inspect the diseases affecting the orbit and eyelids of the eye.
CO2: To comprehend the diseases of conjunctiva and lacrimal apparatus.
CO3: To learn the diseases affecting the cornea.
CO4: To gain knowledge on diseases affecting uvea and sclera.
CO5: To inspect the disease affecting lens.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	M	H	H	H	H	H	H
CO 2	H	H	H	M	H	H	H	M	H	M	H	H	H	H
CO 3	H	H	H	H	M	H	H	M	M	M	M	M	H	H
CO 4	H	H	H	M	H	H	H	H	H	M	M	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Clinical Examination of Visual System (CEVS)

Semester III **Hours of Instruction/week: 4+1**
22BOPC16 **No of Credits: 3**

Objectives:

- To impart knowledge on preliminary examination of eye.
- To gain theoretical and basic practical knowledge in anterior and posterior segment assessment.
- To demonstrate various Orthoptic workups.

Unit I Preliminary Assessment **12**

History taking, Visual acuity estimation, Pupil examination, Hirschberg, Shadow test, Finger tension test, Lid eversion, Torch light examination, Lensometer, Duochrome, Bruckner's red reflex test.

Unit II Binocular Vision Assessment **12**

Extraocular motility, Cover test, Alternating cover test, Near point of Accommodation (NPA), Near point of Convergence (NPC), Stereopsis, Maddox rod, Maddox wing, Hirschberg test, Synaptophore, Krimsky and Modified Krimsky., Saccades and Pursuits.

Unit III Ancillary Assessment **12**

Confrontation test, Amsler grid test, Color vision test, Schirmer's test, TBUT, Tear meniscus level, NITBUT (keratometer), ROPLAS, Photostress test, HVID, VVID.

Unit IV Anterior segment Assessment **12**

Slit lamp biomicroscopy, Keratometry, Digital pressure, Schiotz Tonometry, Applanation Tonometry, Van Herrick Grading. Gonioscopy.

Unit V Posterior Segment Assessment **12**

Direct Ophthalmoscope and Indirect Ophthalmoscope., 90D

Practicals: **15**

1. Lensometer
2. Keratometer
3. Slit lamp biomicroscopy
4. Tonometer
5. Ophthalmoscope

Total Hours 75

Text Books:

1. T Grosvenor: Primary Care Optometry, 5th edition, Butterworth – Heinneman, USA, 2007.
2. D B. Elliott: Clinical Procedures in Primary Eye Care,3rd edition, Butterworth-Heinemann, 2007.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.
2. Jack J. Kanski Clinical Ophthalmology: A Systematic Approach,6th edition, Butterworth-Heinemann, 2007.
3. J.B Eskridge, J F. Amos, J D. Bartlett: Clinical Procedures in Optometry, Lippincott Williams and Wilkins,1991.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To conduct preliminary ocular examination.
CO2: To inspect the binocular vision status of the eye.
CO3: To master the tests used to measure the field of vision, diagnose dry eye, distinguish optic nerve/macular pathology.
CO4: To gain knowledge on anterior segment assessment.
CO5: To comprehend examination of posterior segment examination.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	M	M	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Practical III - Clinical Examination of Visual System

Semester III **Hours of Instruction/week: 4**
22BOPC17 **No of Credits: 3**

Objectives:

- To impart practical knowledge on preliminary examination of eye.
- To gain basic practical knowledge in anterior and posterior segment assessment.
- To demonstrate various Orthoptic workups.

List of Experiments:

1. History taking
2. Visual acuity estimation
3. Pupils Examination
4. Hirschberg test, Modified Krimsky test
5. External examination of the eye, Lid Eversion
6. Extraocular motility, Cover test, Alternating cover test
7. Maddox Rod
8. Stereopsis
9. Saccades and pursuit test
10. Confrontation test
11. Schirmer's, TBUT, Tear meniscus level, NITBUT (keratometer)
12. Color Vision
13. Photostress test
14. Slit lamp biomicroscopy
15. Tonometry
16. Van Herrick Grading
17. Ophthalmoscopy
18. ROPLAS
19. Amsler grid test
20. Contrast sensitivity function test

Total Hours 60

Text Books:

1. T Grosvenor: Primary Care Optometry, 5th edition, Butterworth – Heinneman, USA, 2007.
2. D B. Elliott :Clinical Procedures in Primary Eye Care,3rd edition, Butterworth-Heinemann, 2007.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.
2. Jack J. Kanski Clinical Ophthalmology: A Systematic Approach,6th edition, Butterworth-Heinemann, 2007.
3. J.B Eskridge, J F. Amos, J D. Bartlett: Clinical Procedures in Optometry, Lippincott Williams and Wilkins,1991.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To conduct preliminary ocular examination.
CO2: To inspect the binocular vision status of the eye.
CO3: To master the tests used to measure the field of vision, diagnose dry eye, distinguish optic nerve/macular pathology.
CO4: To gain knowledge on anterior segment assessment
CO5: To comprehend examination of posterior segment examination.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	M	M	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Clinical Psychology

Semester III **Hours of Instruction/week: 3**
22BOPC18 **No of Credits: 2**

Objectives:

- To impart knowledge on clinical psychology and the ideas of Sensation and Determinants.
- To illustrate the human psychology factors and methodologies involved in counselling therapy.
- To provide knowledge on the psychological reaction of patients and rehabilitation.

Unit I Psychology **09**

Introduction to Psychology - Definition, History, Branches, Scope and Current Status. Methods, Concepts of Normality and abnormality in Clinical Psychology

Unit II Sensation and Determinants **09**

Sensation, Attention and Perception, Primary senses, Types of attention and determinants. Principles of perception and determinants.

Unit III Human Psychology Factors **09**

A – Intelligence, B - Learning, C - Memory, D - Personality, E – Motivation and F – Body. Image, personality integration, problem solving and decision making.

09

Unit IV Counseling therapy

Helper - Helpee relationship and Ophthalmic counseling, Characteristics of therapist, Relationship between the therapist and client, Counseling patient with partial sight, colour blindness and hereditary vision defects.

Unit V Reaction and Rehabilitation **09**

Psychological Reaction- A-Illness, loss and Grief; B-Adapting changes in Vision (age, diseases, etc.). Tests for people with disability- WAIS-R. WISC-R (for visually handicapped), Blind learning aptitude tests. Disability and Rehabilitation, Depression, Anxiety and Stress.

Total Hours 45

Text Books:

1. Introduction to Psychology, Morgon C.T., King R.A., Robinson N.M., Tata Mc Graw Hill Publishing Co

Reference Books:

1. Introduction to Psychology, Hilgard and Atkinson, Tata Mc Graw Hill Publishing Co. Psychology 5th Ed. Dworetsky J.P.
2. Child Development Hurlock, EB, VIED, Mc Graw Hill International Book Co. (1981)

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To gain basic knowledge on introduction to Psychology and Concepts of Normality and abnormality
CO2: To understand the basics of clinical psychology and analyse the steps involved in sensation process and determinants.
CO3: To understand the role of counseling and patient and therapist relationship.
CO4: To illustrate the factors involved in human psychology and personality integration.
CO5: To identify the disability and to allow the patients through rehabilitation process.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO
CO 1	H	H	M	M	L	H	H	M	M	L	M	M	M	M
CO 2	H	M	H	M		M	M	M	M	M	H	H	H	H
CO 3	H	H	H	H	L	H	H	H	M	L	H	H	H	H
CO 4	H	M	H	M		H	H	H	H	M	M	H	H	H
CO 5	H	H	M	H	M	H	H	H	M	M	H	M	H	M

DSE III: Epidemiology and Biostatistics

Semester III **Hours of Instruction/week: 2+2**

22BOPD03 **No of Credits: 2**

Objectives:

- To acquire knowledge on disease characteristics, study designs, sources of error and data, screening for disease
- To learn apply statistics to understand disease characteristics
- To apply the knowledge on statistics to understand the natural history of diseases.

Unit I Introduction to Epidemiology **12**

Introduction to Epidemiology - Definition of epidemiology, population and medicine epidemiology, health and disease, natural history of disease, level of prevention, application of prevention and natural history, stroke. Epidemiological concept - the scope of epidemiology, epidemic verses endemic disease, classification of disease, multiple causation of disease.

Unit II Study designs, Measurement, Sources of error and Data **12**

Analytical Studies - Observational verses studies, analytic studies, retrospective and prospective studies, randomized clinical trial. Descriptive epidemiology - person, place, time. Measurements of morbidity and mortality, rates,ratios and proportions, incidence and prevalence rate, crude, specific and adjusted rates, major source of error in measurement of disease. Source of data on community health - censes, vital statistics, morbidity data, linked health records.

Unit III Screening and Sampling **12**

Screening in detection of disease- definition, principle underlying screening programs, evaluation of screening programs. Sampling and sample size determination - sampling strategies, probability and convenience sampling, sample size calculation formula for various study design examples, risk estimation, causation vs. association, bias and confounding, survival analysis.

Unit IV Biostatistics I **12**

Biostatistics - Introduction, population and sample, collection of data, classification and tabulation of data, diagrams and graphs, frequency distribution. Descriptive statistics - Measurement of central tendency, averages, dispersion, skewness and kurtosis. Inferential statistics, probability, theoretical probability distribution. Practical with MS Office Excel. Random variables - Discrete and continuous, probability mass function and density function-simple problem. Moments - relation between central and raw moments.

Unit V Biostatistics II **12**

Chi-square test, binomial, Poisson and normal distribution. Inference about population, sampling methods, hypothesis testing, confidence interval. Practical with MS Office Excel. Students t- test, Analysis of variance, correlation, simple, multiple and logistic regression, demography, computer application in biology, number system. Mathematical statistical software, handling, knowledge, usage and interpretation. Practical with MS Office Excel, SPSS,R

Total Hours 60

Text Books:

1. J.S Mausner and S.Bahn Epidemiology - An introductory text,2nd Ed,W.B. Saunders Co. 1984.
2. V.B Rastogi, Biostatistics, 3rd edition, Medtec Publishers,2015.

Reference Books:

1. L. Gordis Epidemiology, 6th Edition, Saunders 2018.
2. R. J Rossi, Applied Biostatistics for health science, 2/e willey Blackwell publishers,2022.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To digest the facts and myth on epidemiology
CO2: To master the study design, measurement, source of error and data
CO3: To conquer the knowledge on screening and sampling.
CO4: To expertise in descriptive and inferential statistics.
CO5: To subjugate statistics practically.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	M	M	L	M	M	M	M	L	M	M	M	M
CO 2	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 4	H	M	H	M	M	H	H	M	H	H	H	H	H	H
CO 5	M	H	M	H	M	M	M	H	M	M	H	H	H	M

Optometric Optics - II

Semester IV **Hours of Instruction/week: 3**
22BOPC19 **No of Credits: 3**

Objectives:

- To acquire knowledge on multifocal lenses and ophthalmic prisms.
- To illustrate the types of filters and coatings used in lenses.
- To impart knowledge on manufacturing and types of frames.

Unit I Multifocal Lenses **09**

Bifocal designs – manufacturing, types& uses (Kryptok, Univis D, Executive, Invisible, Occupational). Progressive Addition Lenses, modified near vision lenses - designs, advantages, limitations.

Unit II Ophthalmic Prisms **09**

Definition of Prisms, Units of Prism Power, Thickness Difference and Base - Apex Notation, Dividing, Compounding and Resolving Prisms, Rotary Prisms and Effective Prism Power in Near Vision, Prismatic Effect, Decentration, Prentice's Rule, Prismatic Effect of Spherocylinders and Plano Cylinders, Differential Prismatic Effects.

Unit III Lens Enhancements **09**

Special lenses – Lenticular & Aspheric lenses, Fresnel lenses & Prisms,Recumbent prisms, Aniseikonic lenses, High Refractive index glasses, Spectacle magnifiers. Photochromatics, Polaroids, Tinted lens - Tints, Filters. Lens enhancements - Scratch resistant coatings (spin/dip), Anti-reflection coating, UV coating and hydrophobic coating.

Unit IV High Refractive Power Lenses and Aberrations **09**

Lenses for high refractive errors - Design of High Powered Lenses, Hi-index lenses, Calculation of Refractive index. Magnification in high plus lenses, Minification in high minus lenses. Aberration in Ophthalmic Lenses. Tilt induced power in spectacles.

Unit V Frames **09**

History of Spectacles, manufacturing overview, Definition, parts & measurements Classification of frames – Materials, Colours and Temple position - advantages & disadvantages, where to use. Special purpose frames - sports, kids, reading.

Total Hours 45

Text Books:

1. Jalie M: The principles of Ophthalmic Lenses, The Association of Dispensing Opticians, London, 1994.
2. David Wilson: Practical Optical Dispensing, OTEN- DE, NSW TAFE Commission,1999.

Reference Books:

1. C V Brooks, IM Borish: System for Ophthalmic Dispensing, Second edition, Butterworth-Heinemann, USA, 1996.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To gain knowledge on multifocal lenses.
CO2: To understand effects, units, base – apex notation, prismatic effect of Ophthalmic prisms.
CO3: To acquire knowledge on special lenses and lens enhancement coatings.
CO4: To understand high index lenses and aberration of ophthalmic lenses in detail.
CO5: To understand the spectacle frame – manufacturing and their materials.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	M	H	M	H	H	H	H	H	H
CO 2	H	H	M	M	H		M		M	M	M	M	H	M
CO 3	H	H	H	M	M	L	M	M	H	H	M	H	H	H
CO 4	H	H	H	M	H	M	H	H	H	H	M	H	H	H
CO 5	H	H	H	H	M	M	M	M	H	H	H	H	H	H

Visual Optics –II

Semester IV **Hours of Instruction/week: 3+1**
22BOPC20 **No of Credits: 3**

Objectives:

- To understand the fundamentals of optical components of the eye.
- To gain knowledge on visual acuity measurement.
- To acquire knowledge on methods of objective and subjective clinical refraction.

Unit I Refractive conditions **09**

Emmetropia, Myopia, Hyperopia, Astigmatism, Presbyopia. Anisometropia and Anisekonia. Aphakia and Pseudo aphakia. Correction and Management of Amblyopia.

Unit II Accommodation and Convergence **09**

Accommodation- Far and near points of accommodation, Range and amplitude of accommodation, Mechanism of accommodation, Variation of accommodation with age, anomalies of accommodation. **Convergence** - Type, Measurement and Anomalies, Relationship between accommodation and convergence-AC/A ratio.

Unit III Objective Refraction (Static & Dynamic) **09**

Streak Retinoscopy - Principle, Procedure, Difficulties and interpretation of findings, Transposition and spherical equivalent. Dynamic retinoscopy - various methods, Radical retinoscopy and near retinoscopy, Cycloplegic refraction.

Unit IV Subjective Refraction **10**

Principle and fogging, Fixed astigmatic dial(Clock dial),Combination of fixed and rotator dial(Fan and block test),JCC, Duochrome test - Binocular balancing- alternate occlusion, prism dissociation, dissociate Duochrome balance, Borish dissociated fogging, Binocular refraction-Various techniques, MEM, prescribing add and prescription writing.

Unit V Effective Power & Magnification **08**

Ocular refraction vs. Spectacle refraction, Spectacle magnification vs. Relative spectacle magnification, Axial vs. Refractive ammetropia, Knapp's law, Ocular accommodation vs. Spectacle accommodation, Retinal image blur-Depth of focus and depth of field.

Practicals: **15**

1. Objective refraction
2. Subjective refraction
3. Prescribing add
4. Binocular balancing
5. Cycloplegic refraction
6. Alternative test to Cycloplegic refraction
7. Duochrome test
8. MEM
9. Prescription writing

Total Hours 60

Text Books:

1. Bennett AG, Rabbetts RB. Bennett and Rabbetts' clinical visual optics. Elsevier Health Sciences; 1998.
2. Michaels DD. Visual optics and refraction: a clinical approach. Mosby; 1985.

Reference Books:

1. M P Keating: Geometric, Physical and Visual optics, 2nd edition, Butterworth-Heinemann, USA, 2002
2. T Grosvenor: Primary Care Optometry,4th edition, Butterworth –heinneman,USA,2002
3. WJ Benjamin: Borish's clinical refraction,2nd edition, Butterworth Heinemann, Missouri, USA,2006.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To conceptualize various optical components of eye, types of refractive errors and its management.

CO2: To learn the concept of accommodation and convergence in detail.

CO3: To gain knowledge on objective refraction and its type.

CO4: To understand various methods used to achieve accurate subjective refraction.

CO5: To learn the concept of ocular and spectacle refraction.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	M	M	M	H	H	H	H	H	H
CO 2	H	H	M	M	H		H	M	H	M	H	H	H	M
CO 3	H	H	M	M	M	L	M	M	M	M	M	M	H	M
CO 4	H	H	M	M	H	M	H	H	H	M	M	H	H	M
CO 5	H	H	M	H	H	M	H	M	H	H	H	H	H	H

Ocular Diseases – II

Semester IV **Hours of Instruction/week: 5**
22BOPC21 **No. of Credits: 4**

Objectives

- To understand the introduction of pathology and pathology related to Ocular diseases.
- To impart knowledge on anatomy, causes, signs, symptoms, differential diagnosis and treatment of various Ocular conditions.
- To acquire knowledge on diagnostic approach and management of Ocular diseases.

Unit I Choroid & Vitreous **15**

Choroid - Review of Anatomy, Classification, Etiology, Pathology of Choroiditis, Clinical examination of Choroiditis . Vitreous – Review of Anatomy, Developmental Abnormalities, Hereditary Hyaloidoretinopathies, Juvenile Retinoschisis, Asteroid Hyalosis, Cholesterolosis, Vitreous Haemorrhage, Blunt trauma and the Vitreous, Inflammation and the Vitreous, Parasitic Infestations, Pigment Granules in the Vitreous, Vitreous Complications in Cataract Surgery.

Unit II Retina **15**

Retina - Review of 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. Retinablastoma.

Unit III Clinical Neuro Ophthalmology **15**

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 Robetson pupil, Adie's tonic pupil. Optic neuritis, Anterior Ischemic optic neuropathy, Pappilloedema, optic atrophy. Cortical blindness, Malingering, Nystagmus, Clinical examination.

Unit IV Glaucoma **15**

Glaucoma - Review of anatomy and physiology of anterior segment, Clinical Examination, Definitions and classification of glaucoma, Pathogenesis of glaucomatous ocular damage, Congenital glaucomas, Infantile glaucoma, Juvenile glaucoma Syndromes. 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.

Unit V Ocular Injuries **15**

Ocular Injuries: Closed globe injury - contusion, lamellar laceration. Open globe injury - rupture, laceration, penetrating and 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.

Total Hours 75

Text Books:

1. Jack J. Kanski: Clinical Ophthalmology, Butterworths, 2nd Ed., 1989.
2. Stephen J. Miller: Parsons Diseases of the Eye, 18th edition, Churchill Livingstone, 1990.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To understand the symptoms of diseases, diagnostic approach and treatment of Vitreous.

CO2: To identify the symptoms of diseases, diagnostic approach and treatment of retinal and macular disorders.

CO3: To analyse the symptoms of diseases, diagnostic approach and treatment of neuro ophthalmology disorders.

CO4: To explain disease, diagnostic approach and treatment of glaucoma.

CO5: To describe the symptoms of diseases, diagnostic approach and treatment of Ocular Injuries.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	M	H	H	H	H	H	H
CO 2	H	H	H	M	H	H	H	M	H	M	H	H	H	H
CO 3	H	H	H	H	M	H	H	M	M	M	M	M	H	H
CO 4	H	H	H	M	H	H	H	H	H	M	M	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Pharmacology

Semester IV **Hours of Instruction/week: 3**
22BOPC22 **No. of Credits: 2**

Objectives

- To acquire basic knowledge in principles of Pharmacokinetics and Pharmacodynamics.
- To understand commonly used ocular drugs, mechanism, indications, contraindications, drug dosage, and adverse effects.
- To know about drugs used in ophthalmic surgery.

Unit I General Pharmacology **09**

Introduction & sources of drugs, Routes of drug administration, Pharmacokinetics - emphasis on ocular pharmacokinetics, Pharmacodynamics & factors modifying drug actions.

Unit II Systemic Pharmacology - ANS **09**

Autonomic nervous system: Drugs affecting papillary size and light reflex, Intraocular tension, Accommodation; Cardiovascular system: Anti-hypertensive sand drugs useful in Angina; Diuretics: Drugs used in ocular disorders

Unit III Systemic Pharmacology - CNS **09**

Central Nervous System: Alcohol, sedative hypnotics, General & local anaesthetics, Opioids & non-opioids; Chemotherapy : Introduction on general chemotherapy, Specific chemotherapy –Antiviral, antifungal, antibiotics; Hormones : Corticosteroids, Antidiabetics; Blood Coagulants

Unit IV Ocular Pharmacology **09**

Ocular preparations, formulations and requirements of an ideal agent; Ocular Pharmacokinetics, methods of drug administration & Special drug delivery system; Ocular Toxicology

Unit V Diagnostic & Therapeutic applications of drugs used in Ophthalmology **09**

Diagnostic Drugs & biological agents used in ocular surgery, Anaesthetics used in ophthalmic procedures, Anti-glaucoma drugs; Pharmacotherapy of ocular infections –Bacterial, viral, fungal & chlamydial; Drugs used in allergic, inflammatory& degenerative conditions of the eye; Immune modulators in Ophthalmic practice, Wetting agents & tear substitutes, Antioxidants

Total Hours 45

Text Books:

1. K D TRIPATHI: Essentials of Medical Pharmacology. 5th edition, Jaypee, New Delhi, 2004 .
2. Ashok Garg: Manual of Ocular Therapeutics, Jaypee, NewDelhi, 1996

Reference Books:

1. T J Zimmerman, K S Kooner, M Sharir, R D Fechtner: Text Book of Ocular Pharmacology, Lippincott-Raven, Philadelphia, 1997.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To explain the process of drug absorption and distribution mechanism.
CO2: To understand pharmacodynamics process in detail.
CO3: To gain knowledge on Ocular pharmacology and ocular drug delivery methods
CO4: To know ocular drugs and its usage in detail.
CO5: To acquire knowledge on neurotransmitters and toxicity of Ocular drugs.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	M	H	H	H	H	H	H
CO 2	H	H	H	M	H	H	H	M	H	M	H	H	H	H
CO 3	H	H	H	H	M	H	H	M	H	H	H	M	H	H
CO 4	H	H	H	M	H	H	H	H	H	M	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Pathology

Semester IV **Hours of Instruction/week: 3**
22BOPC23 **No. of Credits: 2**

Objectives:

- To learn basics of pathology
- To apply and analyze the pathological basis of ocular diseases
- To know about Inflammation and repair aspects.

Unit I General Pathology **07**

General Pathology - Principles, Pathophysiology of Ocular Angiogenesis, Ocular Infections.

Unit II Eyelids and Orbit **08**

Pathology of eyelids and adnexa. Pathology of orbital space occupying lesions.

Unit III Cornea and Conjunctiva **10**

Pathology of cornea and Conjunctiva, Pathology of Uvea.

Unit IV Lens and Glaucoma **10**

Pathology of Glaucoma, Pathology of Lens

Unit V Retina and Optic nerve **10**

Pathology of Retina, Pathology of retina in systemic disease/disorders, Retinoblastoma. Pathology of the optic nerve.

Total Hours 45

Text Books:

1. Biswas, J. (2010). *Manual of Ocular Pathology*. Jaypee Brother Pub.
2. K S Ratnagar: Pathology of the eye & orbit, Jaypee brothers Medical Publishers, 1997

Reference Books:

1. CORTON KUMAR AND ROBINS: Pathological Basis of the Disease, 7th Edition, Elsevier, New Delhi, 2004.
2. S R Lakhani Susan AD & Caroline JF: Basic Pathology: An introduction to the mechanism of disease, 1993.

Course Outcomes:
On the successful completion of the course, students will be able to

CO1: To know about Inflammation and repair aspects.
CO2: To understand the pathology of various eye parts and ocular adnexa.
CO3: To acquire knowledge on pathology of retina, cornea and conjunctiva.
CO4: To learn about pathology of orbit and optic nerve.
CO5: To understand the pathology of lens.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	M	H	H	H	H	H	H
CO 2	H	H	H	M	H	H	H	M	H	M	H	H	H	H
CO 3	H	H	H	H	M	H	H	M	H	H	H	M	H	H
CO 4	H	H	H	M	H	H	H	H	H	M	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Monocular Sensory Perception

Semester IV **Hours of Instruction/week: 3**
22BOPC24 **No of Credits: 2**

Objectives:

- To picturize the ways through which image is perceived in the retina.
- To depict the perception of various domains of vision
- To visualize the image processing in eye by the human brain.

Unit I Physiology of Vision **10**

Processing of light each layer of retina, types of cells – bipolar, ganglion cells, reception fields, post retinal pathways in terms of visual processing, duplex retina – photopic and scotopic visual system, absolute sensitivity of vision, parallel pathways – magno and parvo reticulo geniculate pathways, and postnatal human vision development.

Unit II Introduction to Visual Psychophysics **09**

Weber's law and Fechner's law, classical concepts of thresholds, modern concepts of thresholds – statistical nature of thresholds, internal and external noise, factors affecting thresholds, psychophysical methods of threshold estimation – methods of limits, staircase and adaptive techniques of threshold estimation, forced – choice procedures.

Unit III Spatial and Temporal aspects of vision **08**

Basic concepts of photometry and radiometry, V lambda function, luminance, illuminance, Modulation Transfer Function (MTF), Contrast Sensitivity Function (CSF), effect of optical and neural disorders on the CSF, spatial summation, Ricco's law, differences between acuity types, conversion of visual acuity to grating acuity, Nyquist limit, temporal procession of vision, critical flicker frequency, temporal summation, Bloch's law.

Unit IV Color vision **08**

Rod and cone spectral sensitivity function, theories of color vision, visual processing involved in color vision perception, clinical testing of color vision and principles.

Unit V Perception **10**

Form perception - Object recognition and Form recognition. Motion perception – theories and depth perception – monocular cues to binocular vision.

Total Hours 45

Text Books:

1. S.H. Schwartz, Visual perception – A clinical orientation, 5/e, McGraw- Hill Medical publishing division, New York, USA, 2017

Online Resource:

https://psych.hanover.edu/javatest/Media/Chapter3/MedFig.LightIntensity.html

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To appreciate the physiology of vision.

CO2: To equip on visual psychophysics.

CO3: To visualize the spatial and temporal aspects of vision.

CO4: To decipher the theories, pathways and principles behind colour vision and colour vision testing.

CO5: To recognize the perception of objects, motion and depth.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	M	M	H	M	H	H	H	H	M	H	H	H
CO 2	H	M	M	M	M	L	M	M	M	M	M	M	M	M
CO 3	H	M	M	M	M	L	M	M	M	M	H	M	M	M
CO 4	H	H	H	M	H	M	H	H	H	H	H	H	H	H
CO 5	H	M	M	M	H	M	H	H	H	H	H	H	H	H

Clinics / Hospital Posting

Semester IV **Hours of Instruction/week: 5**
22BOPC25 **No. of Credits: 4**

Objectives:

- To perform ocular examination to identify ocular diseases
- To treat/manage/rehabilitate the conditions appropriately
- To impart practical knowledge on various Orthoptic workups.

Practicals:

1. History taking – General & Specific conditions
2. Lensometry
3. Vision Check
4. Retinoscopy - Static, Dynamic and Cycloplegic Retinoscopy
5. Subjective Refraction – JCC, Clock Dial, Duochrome, Borish Delayed
6. IPD
7. HVID & VVID
8. Amplitude of Accommodation
9. Near Point of Convergence
10. Maddox rod (Phoria)
11. Schirmer's test
12. Tear Break up time
13. Confrontation test
14. Amsler's Grid test
15. Keratometry
16. Slit lamp examination
17. Finger tension, Applanation Tonometry
18. Van Herick Grading of Anterior chamber depth
19. Color vision test
20. Gonioscopy

Total Hours 75

Text Books:

1. T Grosvenor: Primary Care Optometry, 5th edition, Butterworth – Heinneman, USA, 2007.
2. D B. Elliott :Clinical Procedures in Primary Eye Care,3rd edition, Butterworth-Heinemann, 2007.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.
2. Jack J. Kanski Clinical Ophthalmology: A Systematic Approach,6th edition, Butterworth-Heinemann, 2007.
3. J.B Eskridge, J F. Amos, J D. Bartlett: Clinical Procedures in Optometry, Lippincott Williams and Wilkins,1991.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To perform comprehensive work-up.
CO2: To impart knowledge on history taking.
CO3: To inspect the binocular vision status of the eye.
CO4: To master the tests used to measure the field of vision, diagnose dry eye.
CO5: To gain knowledge on anterior segment assessment.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO
CO 1	H	H	H	M	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	M	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

DSE IV: Public Health and Community Optometry

Semester IV **Hours of Instruction/week: 2+2**
22BOPD04 **No of Credits: 2**

Objectives:

- To promote community based eye care in India.
- To develop Information Education Communication materials on eye and vision care for the benefit of the public.
- To organize health education programs in the community.

Unit I Philosophy of Public Health **10**

History, Concepts and Implementation – Dimensions, determinants and indicators of health

Unit II Health Care Systems **10**

Organization of health services (principles of primary, secondary and tertiary care), levels of disease prevention, levels of health care patterns – contrasting between clinical and community health programmes – Screening for diseases

Unit III Epidemiology and Health Care Programs **10**

Epidemiology of blindness, vision impairment, childhood blindness, Community Eye Care Programs, Community based rehabilitation programs - Vision 2020. National and International health agencies, NPCB. Right to sight, Nutritional blindness with reference to Vitamin A deficiency

Unit IV Modes of Health and Vision Care delivery **10**

Information, Education and Communication for Eye Care programs. KAP, Health manpower and planning & Health Economics, Organization, Management, Promotion of health programmes (eye care programmes) – Service delivery models, Evaluation and assessment of health programmes

Unit V Optometrists and Public health **10**

Role of Optometrist as a primary eye care professional, role of optometrist in public health, organization and management of eye care programmes, role of optometrist in school children eye health, Role of Tele Optometry and its application in Public Health.

Practicals: **10**

1. Preparation of IEC materials
2. Awareness implementation using IEC materials
3. KAP
4. Eye camp

Total Hours 60

Text Books:

1. K Park: Park's Text Book of Preventive and Social Medicine, 19th edition, Banarsidas Bhanot publishers, Jabalpur, 2007
2. Oxford Text Book of Public Health & Preventive Medicine.
3. GVS Murthy, S K Gupta, D Bachani: The principles and practice of community Ophthalmology, National programme for control of blindness, New Delhi, 2002.
4. Newcomb RD, Jolley JL : Public Health and Community Optometry, Charles C Thomas Publisher, Illinois, 1980

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To understand the foundation and basic sciences of public health optometry and health care systems.
CO2: To learn about organization of health care services.
CO3: To acquire knowledge on public health care programs.
CO4: To understand the modes of vision care delivery system.
CO5: To know about Tele Optometry and its application in public health.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	M	H	L	M	H	M	M	H	M	M	H	H	M
CO 2	L	M	H	L	H	M	H	M	M	H	M	L	M	M
CO 3	H	H	H		H	H	H	H	M	M	M		H	H
CO 4	M	H	H		H	H	M	M	M	M	H	M	H	H
CO 5	M	M	H	L	H	H	H	H	H	M	H	H	M	M

Contact Lens – I

Semester V **Hours of Instruction/week: 3**
22BOPC26 **No of Credits: 3**

Objectives:

- To illustrate knowledge on fitting philosophies and recent development of contact lenses.
- To impart knowledge on designing skills of various types of contact lens
- To provide knowledge to students in both theoretical and practical aspects of contact lenses.

Unit I Introduction to Contact lenses **09**

Introduction to Contact lenses and Review of Anatomy and Physiology of Tear film, Lids, Conjunctiva and Cornea. Corneal Anatomy and Physiology, Corneal Physiology and Contact Lens, definition, classification/types of contact lenses.

Unit II History and Manufacturing of Contact Lenses **09**

History and optics of Contact lenses, magnification and visual field, accommodation and convergence, back and front vertex power/ vertex distance calculation. CL materials, properties of different CL materials, indications and contraindications, various manufacturing methods of RGP and Soft CL.

Unit III Soft Contact Lenses **09**

Parameters, design, terminologies, materials, fitting – pre/post fitting, types of fit, calculation/ordering and verification/dispensing of soft CLs including insertion and removal.

Unit IV Rigid Gas Permeable Lenses **09**

Parameters, design, terminologies, materials, fitting – pre/post fitting, types of fit, modifications with RGP's calculation/ordering and verification/dispensing of RGP CLs including insertion and removal.

Unit V Care and Maintenance and Follow Up **09**

Care and maintenance - Cleaning agents & Importance, Rinsing agents & Importance, Disinfecting agents & importance, Lubricating & Enzymatic cleaners, common handling instructions (recap) – insertion/removal techniques, do's and don'ts, follow up care and complications of CL.

Total Hours 45

Text Books:

1. Robber B Mandell: Contact lens Practice, hard and flexible lenses, Charles C. Thomas, 3rd Edition, 1981, Illinois, USA.
2. Ruben M Guillon: Contact lens practice, 994, 1st Edition.

Reference Books:

1. IACLE modules 1 – 10
2. CLAO Volumes 1, 2, 3

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To review the anatomy, physiology of cornea, tear film, lids, conjunctiva, and classify contact lenses.
CO2: To trace the origin of contact lens designs optics, manufacturing and materials of contact lenses.
CO3: To master soft contact lenses.
CO4: To excel rigid contact lenses.
CO5: To perceive the care and maintenance of follow up care of contact lens patients.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Binocular Vision – I

Semester V **Hours of Instruction/week: 3**
22BOPC27 **No of Credits: 3**

Objectives:

- To impart knowledge on the aspects and evolution of binocular vision.
- To gain in-depth knowledge of gross anatomy and physiology relating to the extra ocular muscles.
- To provide a detailed explanation of aetiology, investigation and management of binocular vision anomalies

Unit I Binocular Vision and Space Perception **09**

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 space, Neural aspectsof Binocular vision, BSV. Stereopsis and monocular cues – significance, Egocentric location, clinical applications. Theories of Binocular vision.

Unit II Anatomy & Physiology of EOM and Ocular Motility **09**

Anatomy of Extra Ocular Muscles – Rectii, Obliques and LPS - Innervations & Blood Supply. Physiology of Ocular movements - Center of rotation, Axes of Fick, Action of individual muscle. **Ocular movements**- Uniocular and Binocular movements - fixation, saccadic & pursuits, Version &Vergence, Fixation & field of fixation. **Laws of ocular motility** - Donder's and Listing's law, Sherrington's law, Herring's law.

Unit III Near Vision Complex and Non – Strabismic binocular vision Anomalies **09**

Accommodation and Convergence - Definition and mechanism (process), interaction between vergence and accommodation, Heterophoria – Diagnosis of disorders of accommodation and vergence, treatment with lenses, prisms and occlusion, Vision therapy – Principles and applications.

Unit IV Sensory adaptations, Eccentric fixation and ARC **09**

Sensory adaptations - Confusion, Suppression, Abnormal Retinal Correspondence - Investigations, Management, Blind spot syndrome. Eccentric Fixation - Investigation and management.

Unit V Amblyopia and Nystagmus, Aniseikonia **09**

Classification, Aetiology, Investigation, Management. – Amblyopia, Nystagmus, Aniseikonia.

Total Hours 45

Text Books:

1. Steinman, S. B., Steinman, B. A., &Garzia, R. P. (2009). Foundations of Binocular Vision: A clinical perspective. McGraw-Hill.
2. Mitchell Scheiman; Bruce Wick: Clinical Management of Binocular Vision Heterophoric, Accommodative, and Eye Movement Disorders, 2008, Lippincot Williams & Wilkins publishers.
3. Basic Science, A.A.O - Pediatric Ophthalmology and Strabismus.

Reference Books:

1. Pradeep Sharma: Strabismus simplified, New Delhi, First edition, 1999, Modern publishers.
2. Fiona J. Rowe: Clinical Orthoptics, second edition, 2004, Blackwell Science Ltd.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To know the basis of normal binocular vision and space perception.
CO2: To learn about the theories of binocular vision in detail.
CO3: To understand the gross anatomy and physiology of extra ocular muscles and its motility.
CO4: To acquire knowledge on accommodation and convergence.
CO5: To develop knowledge of various binocular vision anomalies, diagnostic approaches and its management.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Dispensing Optics

Semester V **Hours of Instruction/week: 3**
22BOPC28 **No of Credits: 3**

Objectives:

- To demonstrate verification and dispensing of ophthalmic materials and special practices in clinics.
- To impart the knowledge on lens standards for the usage in the dispensing instruments.
- To illustrate the design and selection of frames for the optics and safety wear.

Unit I Spectacle and Spectacle prescription **09**

Definition, parts and measurements of a spectacle, classification of frames – materials, colours and temple position – uses, advantages and disadvantages, boxing and datum system of measurements, effective diameter and its relevance to lens and frame selection, Components of spectacle prescription & interpretation, transposition, Add and near power relation.

Unit II Frame & Lens selection, markings and Measurements **09**

Frame selection based on ages, occupation, face shape, lens and frame markings- bifocal height, PAL's markings, Lens & Frame markings, Pupillary centers, bifocal heights, Progressive markings & adjustments – facial wrap, pantoscopic tilt, Measuring Inter-pupillary distance (IPD) for distance & near, bifocal height, facial, lens and frame measurements using ABDO's ruler.

Unit III Special frames, lenses and lens coatings **09**

Special type of spectacle frame – monocles, Ptosis glasses, welding glasses, industrial safety glasses, Polaroids, photochromatics, aniseikonic lenses, anti-relection coatings and UV and scratch resistant coatings, lens, frame and coatings considerations for high refractive error glasses.

Unit IV Process followed for dispensing of spectacles **09**

Recording and ordering of lenses (power, add, diameter, base, material, type, lens enhancements), Neutralization – Hand & Lensometer, axis marking, prism marking, and Geneva lens measure, 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 V Frame and Lens availability in Indian market **09**

Frame and lens availability in Indian market, ANSI standards for all lenses and frames, FAQ's by customers and their ideal answers.

Total Hours 45

Text Book:

1. Clifford W Brooks & Irvin M Borish: System of Ophthalmic Dispensing, Professional press, 1979.

Reference Books:

2. Dispensing Optics, Ajay Kumar Bhootra, JP Medical Ltd, 2015.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To explain the interpretation and components of spectacle prescription.
CO2: To identify the faults in spectacles.
CO3: To demonstrate the use of dispensing instruments in lens measurements and frame fittings.
CO4: To identify and select the right frame designs and fittings for the patients.
CO5: To gain knowledge on leading brand frames available in market.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Geriatric Optometry

Semester V **Hours of Instruction/week: 3**
22BOPC29 **No of Credits: 2**

Objectives:

- To infer the general aspects of ageing.
- It helps in perceiving the various factors of ageing – biochemical, social, psychological, physical, mental aspects of ageing in respect to eyes
- It guides in diagnosing and managing the age related eye diseases.

Unit I Introduction to Geriatrics and Prospects of ageing **10**

Introduction to Geriatrics and Gerontology and Prospects of ageing, Geriatrics vs. Gerontology, GNFC – AOA statistics, epidemiology of ageing in India, functional perspective on ageing Social, psychological aspects of ageing, Healthy ageing - Preventive geriatrics – periodic health assessment, lifestyle.

Unit II Biochemistry of ageing and Nutrition for Elderly **09**

Biochemical changes in elderly, Biochemical changes in different ocular structures, nutrition for elderly.

Unit III Disorders of ageing **08**

Age related disorders- physiological and pathological, implications of systemic diseases in eye.

Unit IV Refractive changes and Ocular diseases **10**

Refraction in elderly, structural and physiological changes in the eye, age related eye diseases – orbit, lids, cornea, conjunctiva, lens, uvea, retina, optic nerve, glaucoma.

Unit V Optometric examination and Management **08**

Comprehensive work –up in elderly, Ancillary tests, Optometric management and rehabilitation, Fitting and dispensing in elderly.

Total Hours 45

Text Books:

1. Sharma OP. Geriatric Care-A Text book of Geriatrics and Gerontology. New Delhi: Sanat Printers. 2008.
2. Rosenblatt DE, Natarajan VS. Primer on geriatric care—A clinical approach to the older patient. Cochin: Printer's castle. 2002:2.
3. Alfred A Rossenbloom Jr and Meredith W Morgan: Vision and Ageing.

Reference Books:

1. Edward claffin: Age protectors; Rajendra publishing home Pvt.ltd;Mumbai,1998.
2. Lueck AH. Functional vision: A practitioner's guide to evaluation and intervention. American foundation for the blind; 2004.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To identify, investigate the age related changes in the eyes.
CO2: To counsel the elderly
CO3: To dispense spectacles with proper instructions
CO4: To gain knowledge on common ocular diseases
CO5: To guide in diagnosing and managing the age related eye diseases.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Low Vision Aid

Semester V **Hours of Instruction/week: 3**

22BOPC30 **No of Credits: 2**

Objectives:

- To cognize the causes of low vision.
- To unravel the effects of low vision on activities of daily living of an individual with low vision.
- To enable the learners to examine, envisage the problem and provide appropriate management or rehabilitation.

Unit I Overview of Low Vision Care **09**

Overview of low vision care - Definitions, terminologies, prevalence and Classification.

Unit II Causes **09**

Central field loss, Peripheral field loss, overall blurred vision.

Unit III Role of Optometrist in Low Vision Care **09**

Role of optometrist in patients with low vision process, Low vision care examination in patients with central field loss, overall blurred vision and central field loss, Functional vision assessment.

Unit IV Management, Rehabilitation and Referral **09**

Types of devices - Optical vs Non-Optical, principles of devices, And principles of management. Prescribing low vision devices - Central field loss, peripheral field loss, Overall blurred vision, Care and Management of Pediatric patients, Management of adults. Referrals to appropriate inter- disciplinary service. Social and Psychological factors affecting in Visual adaptation and rehabilitation in children and adults.

Unit V Legal aspects and Recent advances **09**

Legal aspects in India, Recent updates - Virtual reality, augmented reality, mixed reality, visual enhancement systems, Concept of Visual rehabilitation.

Total Hours 45

Text Books:

1. M.V.S Shailaja, G. Sarika, E. Vaithilingam's Practice of Low vision care for eye care professionals, 2/e., SankaraNethralaya, Elite School of Optometry, 2016.
2. C. Dickinson, Low vision principles and practice, Butterworth- Heinemann, Elsevier, 2002.

Reference Books:

1. R. T Jose, Understanding low vision, American foundation for the blind, 2004.
2. B. Silverstone, B. P. Rosenthal, M. A. Lang, E. E. Faye, Light house handbook on Vision Impairment and Rehabilitation (Vol 1&2), Oxford University, 2000.

Course Outcomes:
On the successful completion of the course, students will be able to

CO1: To define low vision.
CO2: To scrutinize the causes of low vision
CO3: To venture the role of optometrist in low vision care.
CO4: To gain knowledge in management and rehabilitation of low vision
CO5: To spectaculate the legal aspects and recent advances in low vision.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Occupational Optometry

Semester V **Hours of Instruction/week: 3**

22BOPC31 **No of Credits: 2**

Objectives:

- To analyze the effects of potential hazards at work place and provide appropriate management.
- To comprehend the visual requirements of different occupations.
- To set vision requirements and standards for various jobs.

Unit I Introduction to Occupational health **09**

Introduction to occupational health, hygiene, safety, National and International bodies, Acts and Rules- Factories act, WCA, ESI acts.

Unit II Occupational diseases **09**

Occupational diseases caused by physical agents, chemical agents, and biological agents, due to radiations: Electromagnetic radiation, ionizing and non-ionizing radiations, diseases due to toxins from metals and chemicals, Pesticides- general and ocular effects, Light- terminologies, illumination, colour and their role, dermatitis and heat stress.

Unit III Occupational safety and Prevention and Visual display units **09**

Occupational analysis: Cause- analysis and prevention, personal protective equipments, prevention, Visual display units – general and ocular effects.

Unit IV Vision standards **09**

Vision standards for jobs (General and specific), Visual task analysis, Creating Vision standards.

Unit V Contact lens and Sports Vision **09**

Contact lenses and Work, Sports vision – need, vision requirements, Ocular complications and their management.

Total Hours 45

Text Books:

1. Dr Santanam's Text book of Occupational. Optometry. 1st ed. Chennai: Elite School of Optometry, Unit of Medical Research Foundation; 2015.

Reference Books:

1. R.V. North, Work and the eye, Butterworth – Hienemann, Elsevier, 2001.
2. G. Jayaraj, Occupational health practice in Indian Industries, Occupational health foundation, 2014.
3. J. Anshol, Visual Ergonomics Handbook, CRC Press, 2019.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To know the rules, laws and act of governing bodies for the welfare of occupational workers.
CO2: To understand the occupational health hazards and its impact.
CO3: To prescribe suitable corrective lenses, therapies, personal protective equipments.
CO4: To understand the vision requirements and standards for various jobs.
CO5: To impart knowledge on occupational Ocular complications and its management.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Practical IV - Contact Lens and Low Vision Aid

Semester V **Hours of Instruction/week: 2**

22BOPC32 **No of Credits: 2**

Objectives:

- To enhance the students with practical knowledge of various procedures.
- To demonstrate CL evaluation and fitting.
- To gain skills in low vision evaluation.

List of experiments:

Contact Lens:

1. Pre fitting evaluation – History, Review of Refraction, Cornea & Tear film assessment
2. HVID & VVID
3. SCL insertion & Removal.
4. Fitting assessment.
5. Over refraction.
6. Follow up examination.
7. RGP CL insertion & Removal.
8. Fitting assessment.
9. Over refraction.
10. Follow-up Examination.
11. Toric contact lens fitting and assessment.
12. Cosmetic contact lens fitting and assessment.

Low Vision:

1. History Taking
2. Refraction, special charts, Radical retinoscopy.
3. Evaluating near vision: Amsler grid and field defects, prismatic scanning.
4. Demonstrating aids – optical, Non-optical, Electronic.
5. Guidelines to determining magnification and selecting low vision aids for distance, intermediate and near.
6. Spectacle mounted telescopes and microscopes.
7. Choice of tests, aids in different pathological conditions.
8. Contact lens combined system.
9. Rehabilitation of the visually impaired.

Total Hours 30

Text Books:

1. Ruben M Guillon: Contact lens practice, 994, 1st Edition.
2. C. Dickinson, Low vision principles and practice, Butterworth- Heinemann, Elsevier, 2002

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To demonstrate insertion and removal of contact lens .
CO2: To demonstrate the instruments used in CL fitting.
CO3: To evaluate the fitting assessments in CL.
CO4: To examine Low Vision patients.
CO5: To illustrate the use of low vision aid in low vision patients.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Clinical Assessment - I

Semester V **Hours of Instruction/week: 3**

22BOPC33 **No of Credits: 4**

Objectives:

- To carry out comprehensive eye examination
- To treat/manage/rehabilitate the Ocular conditions appropriately
- To impart practical knowledge on various Orthoptic workups.

Practicals:

1. History taking
2. External examinations of eye
3. Cover Test & Confrontation Test
4. PGP
5. Visual acuity
6. Orthoptic Workups
7. Objective Refraction
8. Subjective Refraction
9. Subjective Power Verification methods
10. Prescribing Add / Near Power Calculation
11. Slit lamp examination
12. Tonometry
13. Keratometry
14. CL Insertion & Removal
15. Over refraction
16. Direct & Indirect Ophthalmoscopy
17. Color Vision Test
18. Dry Eye Evaluation
19. Final Rx
20. Counselling / Advice

Total Hours 45

Text Books:

1. T Grosvenor: Primary Care Optometry, 5th edition, Butterworth – Heinneman, USA, 2007.
2. D B. Elliott :Clinical Procedures in Primary Eye Care,3rd edition, Butterworth-Heinemann, 2007.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.
2. Jack J. Kanski Clinical Ophthalmology: A Systematic Approach,6th edition, Butterworth-Heinemann, 2007.
3. J.B Eskridge, J F. Amos, J D. Bartlett: Clinical Procedures in Optometry, Lippincott Williams and Wilkins,1991.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To perform comprehensive work-up.
CO2: To gain knowledge on history taking.
CO3: To impart knowledge on refraction.
CO4: To inspect the binocular vision status of the eye.
CO5: To master the tests used to measure the field of vision, diagnose dry eye.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	M	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Hospital Management (Self Study)

Semester V **Hours of Instruction/week: 1**
22BOPC34 **No of Credits: 4**
Objectives:

- To familiarize the learner with basic And advanced concepts of Hospital Management.
- To enable the students to take up consultancy in the Hospital Planning
- To learn the principles of Health Care Administration and its applications in hospital settings

Unit I Basic Concepts of Management 3

Introduction, definition, aims, objectives and role of optometry in various fields - Functions of hospital administration, Organizational structure and design, Administrative responsibilities. Patient-centric management, Organization of hospital departments, Roles of departments/managers in enhancing care.

Unit II Roles and Responsibilities 3

Roles and responsibilities of hospital administrator (CEO), applications of Hospital Information System (HIS) and Management Information System (MIS), Hospital accreditation - NABH rules and regulation, methods of infection control, Hospital Waste Management (HWM). Disaster Management: Rapid response team. Security organization and management; Emergency Management.

Unit III General Administration 3

Admission and discharge procedures – discharge summary – hospital utilizations – Planning of Communication, Modes of Communication – Marketing Management in Health Care System, report of different departments like Medical Officers (MO), NICU, OT, security and maintenance department, – Medico Legal Cases (MLC). Significance of the meetings, follow-up services, feedback.

Unit IV Patient Care Management 3

Patient centric management - Concept of patient care, Patient counselling & Practical examples of patient centric management in hospitals - Patient safety and patient risk management. Clinical Services: Medical Ethics. Outpatient and inpatient services; Accident and Emergency services; Management of Operation Theatres and Labour room service. Laboratory and Radiological services

Unit V Public Health System 3

Project Management - An overview, Definition, Plan-Programme, Projects and Activities; Project identification and formulation; Development Projects – Development and environmental and sustainable development, Project implementation - Planning, Project monitoring, Project organization, Project operations - Structure, System and control.

Total Hours 15

TextBooks:

1. R.C Goyal, "Hospital Administration and HuimanResorce Management", PHI – 4th Edition,2006.
2. G.D.Kunders, " Hospitals – Facilities Planning and Management – TMH", NewDelhi-5th Reprint 2007.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To understand the basic concepts of management .
CO2: To gain knowledge on the role and responsibilities of the hospital administration and applications
CO3: To understand the working nature of the different departments in the hospital .
CO4: To understand the importance of patient care management
CO5: To the basic concepts of public health system.

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PSO1	PSO2	PSO3
CO1	H	M	M	M	M	H		M	H	M	L	M	H	H
CO2	M	H	H	M	L	H	H	H	M	M	H	M	H	H
CO3	M	M	H		M	M	M	H	M	M	M	H	H	M
CO4	M	M	H		H	M	H	H	H	H	H	H	H	H
CO5	H	H	H	M	H	M	H	H	H	H	H	H	H	H

ContactLens–II

SemesterVI **HoursofInstruction/week:3+1**

22BOPC37 **Noof Credits:3**

Objectives:

- Toillustrateknowledgeonfittingphilosophiesandrecentdevelopmentofcontactlenses.
- Toimpartknowledgeondesigningskillsofvarioustypesofcontactlens
- Toprovideknowledgetostudentsinboththeoreticalandpracticalaspectsofcontactlenses.

UnitISoftToriclensFittingandPresbyopia **12**

Fitting,ordering,checking,dispensingtechniquesinhandlingSoftToriclenses,Presbyopiamanagement :Monovision practice, multifocal lens fitting.

UnitIISpecialityandSpecialPurposeContact Lenses **12**

FittinginAphakia,Psuedophakia,Keratoconus:RoseKfitting,PROSEandMini-Scleralfitting(theory).Special purposelenses-Swimming,sports, occupation.

UnitIIIContactlensforPediatricsand Orthokeratology **12**

FittingCLinPediatricpatients,Orthokeratology–principlesandpractice-managementofmyopia.

UnitIVTherapeuticandBandagelenses **12**

Therapeutic/Bandagelens,FittingfollowingSurgeries,Continuouswearlenses,Extendedwearlenses,Frequent Replacements.

UnitVContactLensCareandInstrumentation **12**

Lens care products and solutions, Complications of CL wear, Instrumentation in CL practice,checking finished lens parameters, modification of finished lenses. Advancements and recentresearchin CLpractice.

TotalHours 60

TextBooks:

1. RobberBMandell:ContactlensPractice,hardandflexiblelenses,CharlesC.Thomas,3rdEdition,1981,Illinois, USA.
2. RubenMGuillon:Contactlenspractice,994,1stEdition.

ReferenceBooks:

1. IACLEmodules1 –10
2. CLAOVolumes1,2,3

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To impart knowledge on multifocal contact lens fitting.
CO2: To cognize fitting of contact lenses in special cases.
CO3: To expertise fitting contact lenses in pediatric patients and inspect the role of Orthokeratology in management of Myopia.
CO4: To unravel the mystery behind therapeutic and bandage contact lens.
CO5: To ensure the lens care and instrumentation involved in fitting of contact lens.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Binocular Vision - II

Semester VI **Hours of Instruction/week: 4+1**

22BOPC38 **No of Credits: 3**

Objectives:

- To trace ocular complaints due disturbances in the co-ordination of eye muscles and rectify them.
- To collate the effects of head injury and neurological disease and provide appropriate management.
- To demystify the Strabismus

Unit I Visual perceptual disorders, Learning disabilities and Diplopia **10**

Introduction to visual perceptual disorders, learning disability, Diplopia – causes, tests and management – Prescribing prisms.

Unit II Introduction to Neuro – Optometry **10**

Introduction, ABI – Classification, comprehensive work-up, Management – Prisms, Vision therapy, Rehabilitation.

Unit III Esotropias **15**

Definition, types, causes, clinical presentation, tests and management- surgical and non-surgical.

Unit IV Exotropias **15**

Definition, types, causes, clinical presentation, tests and management – surgical and non-surgical.

Unit V A-V pattern, Cyclo vertical deviations and Special forms of strabismus **15**

Definition, types, causes, clinical presentation, tests and management – surgical and non-surgical.

Practicals: **10**

1. Measurements of Accommodation and Convergence
2. Phoria assessment
3. Lag/lead of accommodation
4. Vergence amplitude assessment
5. Vergence facility assessment
6. Cover test- PBCT
7. Diplopia charting

Total Hours 75

Text Books:

1. Pradeep Sharma: Strabismus simplified, New Delhi, First edition, 1999, Modern publishers
2. Mitchell Scheiman; Bruce Wick: Clinical Management of Binocular Vision Heterophoric, Accommodative, and Eye Movement Disorders, 2008, Lippincot Williams & Wilkins publishers.
3. Basic Science, A.A.O - Pediatric Ophthalmology and Strabismus.

Reference Books:

1. Steinman, S. B., Steinman, B. A., &Garzia, R. P. (2009). Foundations of Binocular Vision: A clinical perspective. McGraw-Hill.
2. Fiona J. Rowe: Clinical Orthoptics, second edition, 2004, Blackwell Science Ltd
3. Christensen LE. Pediatric Ophthalmology and Strabismus Kenneth W. Wright, MD; Peter H. Spiegel, MD. ARCHIVES OF OPHTHALMOLOGY. 2002;120:524-.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To Visualize and cater to the needs of patients with special needs and unify diplopia
CO2: To unravel the course of acquired brain injury and help patients overcome their difficulty
CO3: To demystify Esotropias
CO4: To cognify Exotropias
CO5: To simplify A-V pattern tropias, cyclovertical deviations and special forms of strabismus.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Paediatric Optometry

Semester VI **Hours of Instruction/week: 3**

22BOPC39 **No of Credits: 2**

Objectives:

- To have a knowledge of the principal theories of childhood development and Visual development
- To specialize in examining and apprehending the ocular difficulties in children.
- To provide appropriate management of ocular diseases affecting children.

Unit I Embryology and Milestones **08**

Embryology of eye, developmental milestones.

Unit II History taking and Paediatric Eye examination **08**

History taking, Vision tests for different age groups: Infants, Toddlers, Pre- schoolers, schoolers, teenagers, Paediatric eye examination- refractive status, binocular status, development status, sensory motor ability.

Unit III Paediatric diseases **10**

Diseases affecting the lids, orbit, Cornea, Lacrimal system, Conjunctiva, Lens, Retina, Optic nerve and Glaucoma - Signs, symptoms, Pathophysiology, treatment and management.

Unit IV Paediatric syndromes, Strabismus and Special Children **09**

Syndromes, amblyopia, nystagmus, strabismus and assessment and management of special children.

Unit V Art of Prescribing and Myopia Control **10**

Compensatory and Remedial therapy for Management of Refractive errors. Art of prescribing and dispensing spectacles in children and special children, contact lens - indications, contraindications and practice techniques, Myopia Control – recent researches and evidence based approach.

Total Hours 45

Text Books:

1. Paediatric Optometry - JEROME ROSNER, Butterworth, London 1982
2. Paediatric Optometry – William Harvey/ Bernard Gilmartin, Butterworth –Heinemann, 2004.

Reference Books:

1. Binocular Vision and Ocular Motility - VON NOORDEN G K Burian Von Noorden's, 2nd Ed., C.V.Mosby Co. St. Louis, 1980.
2. Clinical paediatric optometry.LJPress, BDMoore, Butterworth- Heinemann, 1993

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To have knowledge of childhood development and visual development
CO2: To understand the varied assessment concepts of paediatric vision disorders
CO3: To gain knowledge of the epidemiology and treatment of eye disease in children
CO4: To understand the aetiology, clinical presentation and treatment of amblyopia
CO5: To have knowledge of the art of dispensing spectacles, contact lens and low vision aids

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Systemic Disease

Semester VI **Hours of Instruction/week: 3**

22BOPC40 **No of Credits: 2**

Objectives:

- To comprehend the natural history of diseases affecting human being and their management.
- To envisaging facts about common ailments encountered in Optometric clinic.
- To apprehend the impact of the common ailments and their management in eye.

Unit I History and Examination **07**

Medical history: Patient profile – demographics, chief complaints, associated complaints, general health, allergy history, occupational history, social history, family history, summary. Physical, neurological, laboratory and radiological examination – interpretation of test results, diagnostic implications – General and Ocular.

Unit II Cardiovascular, Immune system disorders and Infectious diseases **10**

Diseases affecting the Heart, Kidney, immune system and Infectious diseases - Pathophysiology, clinical signs and symptoms, genetic profile, testing, prognosis, risk factors, other systemic and ocular implications, treatment.

Unit III Pulmonary, GI tract diseases and Endocrine disorders **09**

Diseases that affect the lungs, liver, Organs of GI tract and Endocrine disorders - Pathophysiology, Clinical signs and Symptoms, genetic profile, Prognosis, risk factor, implications and treatment.

Unit IV Haematology, Oncology, Dermatology and Psychological disorders **09**

Cells, Disorders of blood, Cancer, Skin and Psychological disorders - Pathophysiology, clinical signs and symptoms, testing, prognosis, risk factors, genetic profile, other systemic and ocular implications, treatment.

Unit V Neurological disorders, Complications and Implications of Systemic medications **10**

Stroke, CVA, Neurological disorders, Medical emergencies - Pathophysiology, Clinical signs and Symptoms, genetic profile, Prognosis, risk factor, implications and their management, complications of systemic medicines – their management, ocular implications of systemic medications and systemic implications of ocular medications and complications of ocular medicines.

Total Hours 45

Text Books:

1. Bruce Muchnick OD. Clinical medicine in optometric practice. Elsevier Health Sciences; 2007 Oct 24.
2. Ralston SH, Penman ID, Strachan MW, Hobson R, editors. Davidson's Principles and Practice of Medicine E-Book. Elsevier Health Sciences; 2018 Feb 2.

Reference Books:

1. Rabow MW, Papadakis MA, McPhee SJ, editors. Current Medical Diagnosis & Treatment, 2011. McGraw-Hill Medical; 2011.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To cognize the history taking and examining techniques.
CO2: To extricate knowledge on diseases of the CVS, immune system, infectious diseases and their impact in eye.
CO3: To disentangle the diseases affecting Lungs, GI tract, endocrine system and evaluate their ocular comorbidities.
CO4: To investigate the ocular disturbances due to diseases affecting the blood, skin and tumors
CO5: To scrutinize the ocular effects of Neurological disorders, and investigate the Complications

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Law and Optometry

Semester VI **Hours of Instruction/week: 3**

22BOPC41 **No of Credits: 2**

Objectives:

- To create awareness among students regarding their rights and liabilities.
- To safeguard students against future probable litigations.
- To understand medical liabilities

Unit I Introduction to Law and Optometry **09**

Introduction to Law and Optometry - brief about development of optometry in India, definition of optometry, definition of law, theory of proximity, Optometry association. **Professional conduct, etiquette and ethics** - Professional conduct, code of medical ethics, duties and responsibilities of an optometrist in general, duties of optometrists to their patients, responsibilities of optometrist to each other.

Unit II Nature of Contract **09**

Nature of contract - Objective of the law of contract, The Indian contract act, 1872 definition of contract, essential element of a valid contract. Role of consent in medical negligence, importance of consent, relevance of consent in civil law, real and informed consent, In USA, UK and India nature of information required to be furnished by a doctor in India. Concent in emergency cases, concent when invalid, concent implicit, re- exploration without concent or knowledge of patient - necessity is no defense, convenience is no defense.

Unit III Medical negligence and liabilities of a doctor **09**

Medical negligence and liabilities of a doctor - general, civil liability, criminal negligence and civil liability. Existence and breach of legal duty, damage caused by breach, negligence as tort or deficiency in service, medical negligence, legal position - reasonable degree, error of judgements, day to day instances, negligent diagnosis, operation and payment thereof, liabilities of hospital, duty of care, quackery, negligence in eye camp operations, standard of care, liability of legal heirs of deceased doctors, skill of medical men, proof of negligence, role of medical record, elaborate evidence, shifting on onus- don's and don'ts for doctors and patients, checklist for optometrists and patients.

Unit IV Consumer rights and Nature of Medical Service **09**

Provision of Consumer Protection act 1986, general nature of medical service -appeal and revision, limitation in the context of medical negligence, cause of action accrues in favour of complaints and the reason- penal provisions.

Unit V Medical evidence and Medical witness **09**

Medical evidence and Medical witness: Evidence - examination of witnesses, medical certificate, expert opinion treatise - medico legal report. Eye donation and transplantation of the human organs act, 1994 - clinical establishment act, 2010 - procedures in civil court, criminal court and the consumer forums.

Total Hours 45

Text Books:

1. B. Vijayakumar, Law and Optometry - A guide for vision care professionals and Optometry students in India. Elite School of Optometry and SankaraNethralaya Publications, Chennai India 2017.

Reference Books:

1. Y. V. Rao. Y. V. Rao Law Relating to Medical Negligence, 3/e, Asia Law House, Hyderabad 2019.
2. A.K Sharma, S. D. Joshi. Legal boundaries in Ophthalmology. DrSharmas' Legal ConsultancyPublications. Maharashtra, India 2004.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To describe the evolution of Indian Optometry, definition and theory of proximity.
CO2: To cognize Professional conduct, etiquette and ethics necessary for Clinical Optometry practice in India.
CO3: To apprehend on the nature of contract from Indian Perspective and the role of consent in medical negligence.
CO4: To discuss about Consumer rights and nature of medical service.
CO5: To comprehend role of evidence and witness in medical service.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO
CO 1	H	L	M	L	L	H	H	M	M	L	L	M	H	M
CO 2	H	M	H	M		H	H	H	H	M	M	H	H	H
CO 3	H	M	M	M	M	H	H	M		L	M	M	H	M
CO 4	H	M	H	M	M	H	H	H	H	M	M	H	H	H
CO 5	H	M	M	M	M	H	H	M	M	M	H	M	H	M

Practical V - Binocular Vision and Paediatric Optometry

Semester VI **Hours of Instruction/week: 3**

22BOPC42 **No of Credits: 3**

Objectives:

- To carry out perfect Orthoptic workup
- To adapt skills and interpret clinical results following investigation of binocular vision anomalies
- To provide appropriate management of ocular diseases affecting children.

List of experiments:

1. History taking
2. Stereopsis- Different Methods
3. Vision check
4. Refraction
5. IPD
6. Extra ocular Motility
7. Measurements of Accommodation and Convergence
8. Phoria assessment
9. Amplitude of accommodation
10. Lag/lead of accommodation
11. Accommodative facility
12. AC/A ratio
13. Relative accommodation testing
14. Vergence amplitude assessment
15. Vergence facility assessment
16. Cover test- PBCT
17. Fusion &Supression- Worth 4 Dot test
18. Diplopia charting
19. Hess charting
20. Vision therapy techniques

Total Hours 45

Text Books:

1. Pradeep Sharma: Strabismus simplified, New Delhi, First edition, 1999, Modern publishers. Paediatric Optometry - JEROME ROSNER, Butterworth, London 1982.
2. Paediatric Optometry – William Harvey/ Bernard Gilmartin, Butterworth –Heinemann, 2004.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To understand the aetiology, clinical presentation and treatment of amblyopia
CO2: To understand the measurements of Accommodation and Convergence tests
CO3: To practically gain knowledge on Phoria and Tropia assessment
CO4: To practically impart knowledge on diplopia and hess charting
CO5: To gain knowledge on Vision Therapy techniques

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	M	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Clinical Assessment - II

Semester VI **Hours of Instruction/week: 5**

22BOPC43 **No of Credits: 4**

Objectives:

- To carry out comprehensive eye examination
- To treat/manage/rehabilitate the Ocular conditions appropriately
- To impart practical knowledge on various Orthoptic workups.

Practicals:

1. History taking
2. External examinations of eye
3. Cover Test & Confrontation Test
4. PGP
5. Visual acuity
6. Orthoptic Workups
7. Objective Refraction
8. Subjective Refraction
9. Subjective Power Verification methods
10. Prescribing Add / Near Power Calculation
11. Slit lamp examination
12. Tonometry
13. Keratometry
14. CL Insertion & Removal
15. Over refraction
16. Direct & Indirect Ophthalmoscopy
17. Color Vision Test
18. Dry Eye Evaluation
19. Final Rx
20. Counselling / Advice

Total Hours 75

Text Books:

1. T Grosvenor: Primary Care Optometry, 5th edition, Butterworth – Heinneman, USA, 2007.
2. D.B.Elliott:Clinical Procedures in Primary Eye Care,3rd edition, Butterworth-Heinemann, 2007.

Reference Books:

1. A K Khurana: Comprehensive Ophthalmology, 4th edition, New age international (p) Ltd. Publishers, New Delhi, 2007.
2. Jack J. Kanski Clinical Ophthalmology: A Systematic Approach,6th edition, Butterworth-Heinemann, 2007.
3. J.B Eskridge, J F. Amos, J D. Bartlett: Clinical Procedures in Optometry, Lippincott Williams and Wilkins,1991.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1: To perform comprehensive work-up.
CO2: To gain knowledge on history taking.
CO3: To impart knowledge on refraction.
CO4: To inspect the binocular vision status of the eye.
CO5: To master the tests used to measure the field of vision, diagnose dry eye.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 3	H	H	H	M	H	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	M	H	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	M	H	H	H	H	H	H

Project

Semester VI **Hours of Instruction/week: 4**

22BOPC44 **No of Credits: 4**

Objectives:

- To provide a structured systematic research experience to the students involving all phases of research.
- To perform a project and trained to perform literature review, methodology, collect and analyze data
- To write their dissertation and defend their project.

Guidance:

Each student will receive guidance from the optometry teacher towards referring relevant literature / collect required data and discuss them with the project guide periodically.

After correction and edition of handwritten manuscripts by the project guide, the student will compile his / her study / work into a manual form for submission to the institution of study.

Under case study, the student may study the patients in clinical areas, consolidate the findings and discuss them with the project guide before compiling into final shape.

Course outcomes:

On the successful completion of the course, students will be able to

CO1: To acquire the basic knowledge and experience of conducting research systemically.
CO2: To become a part of research team
CO3: To demonstrate an understanding of the relevant roles and responsibilities involved.
CO4: To organize and conduct research using various interventions
CO5: To write a project report with good APA style for scholarly writing.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	M	M			M	H	H	H	H	H	M
CO 2	M	H				M	M	H		M		M	H	
CO 3	H	H	H	M	H	M	H	M	M	H	H	H	H	M
CO 4	H	H	H	M	H	H	M		H	H	H		H	
CO 5	M	H					H		H	M			M	