Syllabus for written examination for following posts as detailed under:

Sl. No.	Name of Post	Pay Band & Grade Pay	Age limit for direct recruitment	Sanctioned Post	Man-in-position	Vacancy to be filled-up	Education qualification required for direct recruitment and other eligibility conditions
01	02	03	04	05	06	07	08
01	Optometrist	Level 11 in Pay Matrix	18-40 years	06	NIL	05	B. Sc. in Optometric from a recognized University / Institute
02	Ortho Optician	Level 11 in Pay Matrix	18-40 years	03	NIL	03	B. Sc. Ortho Optometric from a recognized University/ Institute
03	Ophthalmic Lab Technician	Level 11 in Pay Matrix	18-40 years	08	NIL	08	B. Sc. Ophthalmology from a recognized University/ Institute

Sl. No.	Subjects/ course
01	02
i)	Geometrical Optics (Optics I)
ii)	Physiology (General)
iii)	Anatomy (General)
iv)	Biochemistry (General &Ocular)
v)	Professional Communication in English
vi)	Physical Optics (Optics II)
vii)	Physiology (Ocular)
viii)	Anatomy (Ocular)
ix)	Environment & Ecology
x)	Computer Fundamentals & Programming
xi)	Visual Optics (Optics IV)
xii)	Ophthalmic & Optical Instrumentation & Procedure II
xiii)	Clinical Refraction I
xiv)	Ocular Disease I (Anterior Segment Disease)
xv)	Ophthalmic Lens & Dispensing Optics
xvi)	Binocular Vision & Ocular Motility
xvii)	Contact Lens I
xviii)	Clinical Refraction II
xix)	Ocular Disease II (Posterior &Neuro-eye Disease)
xx)	Low Vision Aids & Visual Rehabilitation
xxi)	Systemic Condition & the eye
xxii)	Public Health & Community Optometry
xxiii)	Biostatistics
xxiv)	Contact Lens II
xxv)	Professional Practice Management
xxvi)	Applied Optometry & Orthoptics

28/04/15

I. ANATOMY (General)

01. Introduction of anatomy – gross human anatomy & their relations :

i). The skeleton – axial & appendicular (over view), Cavities of body- (cranial, thoracic, abdominal, pelvic).Structure of bone, Type & function of bone, Blood & nerve supply of the bone.Planes of the body.Anatomical terminology.

ii). Skull – General features, Cranial bones (frontal, parietal, temporal, occipital, sphenoid, ethmoid). Facial bone– (nasal, maxilla, zygomatic, lacrimal, palatine, inferior nasal conchae, vomar, mandible). Special feature ofthe skull (sutures, paranasal sinuses, foramina, fontanels, nasal septum).

iii). Joints – classification, fibrous joints, cartilaginous joints, synovial joints(structure & types). Types ofmovement at sinovial joints.

iv). Anatomy of muscular system – Skeletal muscle structure. Important skeletal muscle (muscles of facialexpression, mastication. Muscle that move the head). Over view of Trunk muscles, upper limb muscles, lowerlimb muscles.

v). Anatomy of nervous system – spinal cord anatomy (external & internal anatomy). Connection & distributionof spinal nerves-overview(Branches, plexuses.Intercostal nerves).Overview of brain organization & bloodsupply.Brief anatomical idea on – brain stem, cerebellum, diencephalon, cerebrum. Cranial nerves

02. Embryology – general

Gametogenesis(spermatogenesis & oogenesis) –Structure of testis,ovary &sperm –Phases of embryonicdevelopment – formation of three germ layers- derivatives of germ layers –Embryonic or Foetal membrane(chorion, amnion, allantois, yolk sac) &placenta & its functions.

03. Cell Structure:

Ultra structure and functions of cell- Plasma membrane- Nucleus – Mitochondria-Centrosome-Ribosome-Endoplasmic reticulum- Golgi body & lysosome. Nucleus – Ultra structure & functions.

04. Chromosomes:

Structure & chemical composition, types of chromosome.Chromosome aberration.

05. Cell Division:

Amitosis- Mitosis- Meiosis- Significance of mitosis & meiosis- Cell cycle.

06. Tissues:-

Structure, position and functions of epithelial, connective, muscular & nervous tissue.

28/1/19

II. PHYSIOLOGY

GENERAL PHYSIOLOGY

01. Basic Biological (Biophysical & Biochemical) Principles:

Diffusion, surface tension and viscosity – their characteristics, factors influencing and biological applications.Osmosis – osmometers, laws of osmosis, biological applications, relation with depression of freezing points.Acids, bases and pH. Colloids – classification, properties – optical and electrokinetic, biological importance ofcolloids. Dialysis and ultra-filtration. Chromatography: Principles & applications, Electrophoresis: Principles &applications, Gel electrophoresis. Ultracentrifugation: moving boundary and density gradient ultracentrifugation. Adsorption.Gibbs-Donnan equilibrium. Radioactivity – radioisotopes and their biological applications. Principlesof radioimmunoassay (RIA), autoradiography.The resting membrane potential.The action potential.Electrotonicpotentials.Propagation of nerve impulse in different types of nerve fibers. Compound action potentials.

02. Genetics:

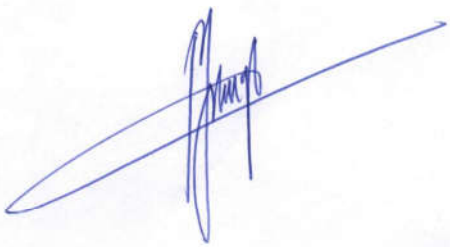
Nucleic acid- 1. Structure of DNA- Physical & Chemical properties of DNA & RNA, Ultra structure & types ofDNA & RNA(in details), Brief idea about super coiling of DNA Semiconservative mode of replication of DNA,Mechanism of replication of DNA, ,Genetic code. Genetically relation of color blindness and ocular albinism.Chromosome aberration- Structural aberration- Deletion- Duplication- Inversion- translocation.Numericalaberration (Polyploidy & aneuploidy- Hyper & hypo).Gene mutation- classification-spontaneous & Induced-Chemical mutation- Practical Application of mutation.

03. Blood Vascular system

Composition and functions of blood.Plasma proteins – normal values, origin and functions.Brief idea on Bonemarrow.Formed elements of blood – origin, formation, functions and fate.Hemoglobin – functions, compoundsand derivatives. Abnormal hemoglobin-overview.Thalassemia-brief idea. Different types of anemia and theircauses-overview. Erythrocyte sedimentation rate (ESR) and its significance. Hematocrit. PCV, MCV, MCH,MCHC. Blood volume – normal values, regulation.Blood coagulation – factors, process, anticoagulants,Prothrombin time.Clotting time.Bleeding time.Blood groups – ABO systems and Rh factors.Blood transfusion.Ultra structure & functions of blood vessels (artery & vein).Structure type and function of capillaries.Differencesbetween artery & vein.

04. Muscular Physiology:

Microscopic and electron microscopic structure of skeletal, smooth and cardiac muscles.Difference betweenskeletal, smooth and cardiac muscles.The sarcotubular system.Red and white striated muscle fibers. Single unitand multi unit smooth muscle. Motor point. Properties of muscle: excitability and contractility, all or none law,summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue,refractory period, tonicity, conductivity, extensibility and elasticity. Electromyography. Muscle contraction – E CCoupling, Muscle fatigue, Rigor mortis, Sliding filament theory, Slow & fast muscle fibers, Isotonic & Isometric contraction.



05. Neuro Physiology

Electron microscopic structure of nerve cell or neurons.Neuroglia.Myelinated and unmyelinated nerve fibers.Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibers.Properties of nervefibers – excitability, conductivity, all-or-none law, accommodation, adaptation, summation, refractory period,indefatiguability.Concept of chronaxie and rheobase. Synapses – types, structure, synaptic transmission of the impulse, synaptic potentials, eurotransmitters. Motor unit.Injury to peripheral nerves – degeneration andregeneration-brief idea.Automatic nervous system – Introduction, Comparison of autonomic & somatic nervous system, Anatomy of autonomic motor pathways – Pre-ganglionic neurons, autonomic ganglia, sympathetic ganglia, autonomicplexus, post-ganglionic neurons structure of sympathetic and parasympathetic division. ANS- neurotransmitter andreceptors- cholinergic neurons & receptors.Receptor agonist & antagonist.Physiological effect of ANSsympathetic& parasympathetic response.Integration & control of autonomic function- autonomic Reflexes,autonomic control by higher centers.Neural Transmission-Introduction, Autonomic Synaptic Transmission-Modes of transmission, sympathetic &parasympathetic response.CNS Synaptic transmission-Electrical synaptic transmission & chemical synaptictransmission.Neuro muscular Junction – The neuromuscular junctions – structure, events in transmission, end-plate potential,post tetanic potential.

06. Cardio Vascular System –

Structure & function of Heart & blood vessels (artery, vein and capillary) (Anatomical position, chambers ofheart.)Blood circulation through heart. Special junctional tissue of heart.(Myogenic and neurogenic heartconductingsystem of heart. E.C.G. Cardiac cycle. Heart Sound , Blood vessels – type, Structure & function,Systemic & pulmonary circulation. Blood – composition, Function, blood group, Blood clotting. Cardiac cycleand cardiac output.Blood Pressure-regulation & controlling factors.

07. Renal System-

Function of kidney, Anatomy & Histology of Nephron & collecting duet. – Urineformation(Filtration, reabsorbtion and secretion)- Counter – current system of urine concentration, Anomalies inurine concentration.

III. GEOMETRICAL OPTICS-I

01. What is light- dual nature- particle & wave nature, speed, wave length & frequency of light.
02. Fermats' principle- laws of relation & refraction at a plane surface using Fermats' principle.
03. Snells' law, relative and absolute refractive indices, total internal reflection and Critical angle, refraction by plane parallel slab of glass; molecular basis of reflectively
04. Geometrical path length & optical path length of rays, Concept of wave fronts & rays, concept of vergencedivergence convergence.
05. Refraction by spherical surfaces- convex & concave, Derivation of vergence equation, focal points, deportee power, image point, lateral & axial magnification, simple numerical.
06. Thin Lens- shapes, derivation of lens makers' formula, thin lens vergece equation, equivalent focal length oftwo thin lenses separated by a distance & placed in contact, lateral magnification of thin lenses in contact,simple numerical, concept of reduced systems.
07. Thick Lens- Cardinal points & planes, front & back vertex power, matrix theory in paraxial Optics to locate positions of cardinal planes. Different types of aberrations & their effects.
08. Prism- Dispersion of prism, reflecting prisms , prisms diopters.
09. Geometrical theory of optical fibers. Uses of optical fibers.

IV. BIOCHEMISTRY

01. Basic concept & metabolism of carbohydrate, protein & fat.Process of glycolysis, glycogenolysis, TCA cyclesignificance.Non Protein Nitrogen, Nitrogen balance, Metabolism of Amino acids, Transamination, Deamination.Process of _____-oxidation of unsaturated fatty acid, _____&_____ oxidation overview.

02. Amino acids, protein structure.

i). Amino acids- Function, classification, properties
ii). Protein - Primary, secondary, tertiary & quaternary structures & the bond involves.

03. Brief outline: Enzyme-

General characteristics, classification, Factors affecting enzymatic activity. Kinetics of Enzyme – km. MichaelisMenten equation. Line Weaver Burk plot.Enzyme Inhibition – Reversible & Irreversible.Allosteric enzyme.

04. Oxygen transporting protein

Hemoglobin& Myoglobin – Structure & their characteristics. Comparison between hemoglobin& myoglobin.Oxygen transporting Mechanism of Hemoglobin affinity for Oxygen. Bohr's effect

05. Vitamins

Water & Fat soluble Vitamins. Vitamins- A,D,E,KP,C B complex- source, daily requirement, Metabolism,Functions, deficiency.

06. Basic outline of hormone action

Physical & Chemical Characteristics of hormone.Types of hormone.General mechanism of hormone action viaMassenger system. Source & importance of different hormones-STH, ACTH, GTH, T4, parath hormone, Insulin,Glucagon, Glucocorticoid, Mineralocorticoid, Melatonin, Estrogen, Progesteron, Testosterone & HCG

07. Cornea – Biochemical composition of cornea. Sources of Nutrients-Oxygen, Glucose, Amino acid.Metabolicpathway in cornea – Glycolysis, HMP shunt.

08. Tear film-

Functions of Tear film. Different layers of Tear film. Chemical composition of tears. Tear film abnormalities.Tests for film Adequacy.

09. Lens – Biochemical composition of lens. Lens protein – their types & characteristics.Lens Metabolism -Carbohydrate metabolism, protein metabolism. Cataract – Due to biochemical defects of lens. Antioxidant mechanism in the lens.

10. Biochemistry of the visual processPhotopigments – Rhodopsin &Iodopsin. Chemical nature of Rhodopsin.Visual cycle (Bleaching of Rhodopsin,Transducin cycle, Role of Phosphodiestareses).

V. PHYSIOLOGY (Ocular)

1. Cornea:Brief idea about ultra & histological structure of cornea. Corneal transparency & hydration, Regulation of cornealtransparency & hydration. Corneal vascularization. Maurice theory & Goldman's theory

2. Uveal tissue:Brief idea about uvea. Uveal meshwork.Uveo-scleral drainage.Schlemm's canal switch.

3. Lens:Basic idea about human lens. Function of lens. Lens transparency.Lens culture.Changes in ageing lens. Cataract – overview.

4. Aqueous humour:Formation of Aqueous humour. Drainage & circulation of Aqueous Humor.Rates of production & flow. Functions of Aqueous humour.

5. Vitreous Humour:Composition & distribution of vitreous humour, Physiology & function of vitreous humour, Optical role of vitreous humour.

6. Retina:Retinal structure-layers of retina. Brief idea about rod & cones.Organization of retina. Function of retina.

7. Optic Nerve: Physiology of optic nerve. Papilledema of optic nerve.Optic atrophy.

8. Ocular Circulation : Vascular structure of the eye – ocular circulation, blood-ocular barrier (Blood-retinal,blood Vitreous & blood aqueous barrier). Regulation of ocular circulation.

9. Protective Mechanism of the eye –

a. Blinking – muscles of lead closer & lid opening (orbecularisocculli, levatorpalpebre, Muller's muscle,blinking reflexes.

b. Lacrimation –

i) Lacrimal glands

ii) Pre corneal tear film

iii) Chemistry of lachrymal secretion tear film

iv) 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.)

10. The ocular motor system –

a. Extra ocular muscles their function & nerve supply

b. Mechanics of actions of extra ocular muscles -cross sectional area of muscle, length of muscle. Arc ofcontact, muscle plane, Muscle axis of rotation.

c. Physiology of ocular movement – Basic Kinematics, (position of gaze, Fick's axes)

d. Ocular Movement (monocular and Binocular). Supra nuclear control of eye movements.

e. Ocular movements -

i) Monocular Movements (Adduction, Abduction, supraduction, Infraduction, Incycloduction, excycloduction)

ii) Binocular Movements –VERSIONS- (saccadic & pursuit movement, position maintenance movements, stabilization movements & their characteristics). VERGENCES – (Convergence, divergence, vertical vengeance),

11 . Intraocular pressure –Features of normal IOP, Factors influencing the IOP,Control of IOP,Measurement of IOP.

12. 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

13. Accommodation –

a. Far point , near point, range & amplitude of Accommodation

b. Mechanism of accommodation – Increased tension theory, Relaxation theory, Role of lens capsule,Gullstrand mechanical model of accommodation,

c. Stimulus for accommodation

d. Ocular changes in accommodation.

e. Changes in accommodation with arc (Presbyopia)

f. Nervous mechanism for accommodation

14.Colorvisiona.

a. Physiological, Photochemical & neurological basis of color vision

b. Electrophysiology of color vision

c. Granit's modulator and dominator theory, Purkinje phenomenon. Young-Helmholtz theory

d. Types of color defects

e. Color blindness

f. Neural analysis

15. Geneculate cortex:

a. Structure of geneculate cortex.

b. Electrophysiology

c. Projection – retinal projection

d. Detail idea about visual cortex & function of visual cortex.

16. Visual perception –

a. Higher integrative activity, Binocular perception, stereoscopic depth perception.

b. Neurophysiology of perception – Higher visual pathways(primary visual Pathway to cerebral center, LateralGeniculate body, non-geniculate targets for retinofugal input, visual center)

c. Neurophysiology of perception – Spatial analysis, Double pathway to higher visual centers.

17. Physiology of vision –

a. Visual acuity – visual angle, Components of Visual acuity (Minimum visible, Resolution , RecognitionHyperacidity), Factors affecting, Measurement of visual acuity.

b. Contrast Sensitivity – Types- (spatial & Temporal contrast sensitivity), Neural Mechanism, Measurementof contrast sensitivity (Arden gratings , Cambridge low contest gratings, Pelli – Robson chart)

c. Light & Dark adaptation – Dark adaptation curve, Mechanism of dark adaptation, Factors influencingdark adaptation, Time course of light adaptation, Mechanism of light adaptation, Rod vs. cone lightadaptation.Parkinje shift of spectral sensitivity.

d. Binocular vision – Grades of binocular vision (simultaneous, fusion &stereopsis), Advantages ofbinocular vision, visual direction &horopter, Binocular fusion, Dichoptic stimulation , Depth perception,Integration of motor & sensory system.

e. Electrodiagnostic tests – ERG, EOG, VER

VI. ANATOMY (Ocular)

1. Embryology –ocular

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

2. Orbit

Bony orbit→Size, shape & relations, walls of the orbit , Base of the orbit, Apex of orbit.

Orbital fascia →Fascialbulbi, Fascial sheaths of extraocular muscles, intermuscular septa.

Spaces of orbit →Orbit fat & reticular tissue - Apertures at the base of orbit- Contents of the orbit – Orbitalnerve→oculomotor , Trochler, Abducent, Trigeminal, facial nerves - their functional components, course &distribution, clinically applied aspects.

3. Cornea→(a)Layers & peculiarities,(b). Blood supply & nerve supply of cornea. .(c) Corneal Transparency.

4. Lens ,Zonules→(a) Structure. of lens →capsule, Ant. Epithelium, lens fibers (structured &zonal arrangement), (b). Ciliaryzonules→structure gross appearance,(c). Arrangement of zonulesfibers.

5.Uveal Tract & its vascular supply→(a). Iris macroscopic & microscopic appearance . (b) ciliary body –Macroscopic structure.(c). chloride - Macroscopic structure.(d) Blood supply to uveal structure-short & LongPosterior artery & Anterior Artery. (e). Venous drainage.

6.Vitreous- main masses of vitreous. Base of the vitreous.Hyaloidean vitreous.Vitreous cells.

7. Sclera – Anterior, posterior & middle apertures. Episclera.Sclera proper.Lamina fusca. Blood supply of thesclera. Nerve suply of the sclera.

8. Anterior chamber and its angle- angle of the anterior chamber. Trabecular meshwork.Canal of Schlemm.Schwalbe's line.Drainage of aqueous humor.

9. Retina & its vascular supply →(a). Gross anatomy,(b). Microscopic structure of fovea centralize, (c). Bloodretinal barrier.(d.) Anatomy of optic nerve, (e).Anatomy of optic nerve, (f.) optic chaisma optic tracts, (g) LateralGeneculate body, (h).optic radicalism (i). visual cortex, (j). Arrangement of nerve fibers.(K). Blood supply ofvisual pathways (Arterial circle of willis & its branches).

10.The Ocular motor system →Extraocular muscles, nerve supply, motor nuclei, supra nuclear motor centers.

11.The pupillary &ciliary muscle →Anatomy of sphincter & Dilator muscle. Ciliary muscle – Anatomy, types

12. The nerve supply of the eye ball.

13.The lachrymal appears →(a) Lachrymal gland, (b) Palpebral part, (c) Duets of lachrymal gland, (d)structure of the lachrymal gland, (e) Blood supply & nerve supply of the lachrymal gland, (f) lachrymal passages.

14. Anatomy of the Ocular Adnexa & glands; Lids - a. Structures of the lids: - Skin, SubcutaneousAreolar Layer, Layer of Staiated muscle, Submuscular Areolar Tissue, Fibrous Layer, Conjunctiva.Glands of theLids- Meibomaian Glands, Glands of Zela and Glands of Moll. Blood Supply of the Lids, Lymphatic Drainage ofthe Lids, Nerve Supply of the Lids.Conjunctiva - Palpebral Conjunctiva, Bulbar Conjunctiva, Conjunctival Fornix, Microscopic Structure of theconjunctiva-Epithelium, SubstantiaPropria. Conjunctival Glands→Krause's Glands, Wofring's Glands, Henley's Glands, Manz Glands.Blood Supply of the Conjunctiva, Nerve Supply of the Conjunctiva, Caruncle,PlicaSemilunaris.

VII. COMPUTER FUNDAMENTALS AND PROGRAMMING

01. Basic computer Architecture:
Fundamentals of Computers, Block diagram of PC, peripheral devices of PC and their functions

02. Number System & Data Representation:
Decimal Number System, Binary number system, Decimal to Binary conversion, Binary operations.Octal numbersystem & the conversion.Octal to Decimal.Binary to Octal & Vice Versa.

03. Boolean Algebra:
Definition, Difference between Boolean with Arithmetic & ordinary algebra. Two valued Boolean Algebra. Basictheorems of Boolean Algebra. Precedence of voperators.Boolean function & truth tables. The AND, OR, NOTgate. DeMorgans theorem. The NOR, NAND gate. The XOR & X-NOR gate. Conversion of Boolean expressioninto logic diagram. Using AND, OR, AND, NOT gates.

04. Logic Circuits:
Combinational logic circuit, Adder ,Subtractor, Decoder, Encoder.

05. Operating System:
Introduction & classification of software, working principle of MS DOS (Some basic internal & externalcommands). Creating a file.Windows & its components.Accessories, program manager, main, desktop icons.

06. MS- Office:
Introduction of word processing-invoking MS-word – create, edit, save document, cut & paste perform operationson blocks of text, header & footer, Mail Merge, printer setup. Introduction of EXCEL.Concept of worksheet,making Charts & graphs, perform calculations & re calculations.

07. C-Language:
Overview of C , algorithm & flow chart, datatypes. Variables & constants, operators, expressuions& assignmentstatements, control statements, arrays in C (Onedimentional).

08. Introduction to Internet:
Basic concepts of Internet.

VIII. PHYSICAL OPTICS

01. Dual nature of light- Simple harmonic motion- differential; Simple harmonic waves- mathematicalrepresentation; Super position of simple harmonic waves.

02. HUYGENS' principle – laws of reflection and refraction at plane and spherical surfaces. Wave velocity & group velocity; determination of velocity of light (any one method.)

03. Interference: Coherence; path and phase difference; Theory of interference fringesintensity distribution infringes; Young's double slit experiment- Fresnels' biprism,Lloyds' error experiments; visibility of fringes.

04. Interference in thin films due to reflected and transmuted light- Interference in wedge Shaped films; Newton's ring experiment ;Color of thin films; Thin film antireflection wating and filters

05. Diffraction:

06. Diffraction by single slit; double slit, multiple slit- grating, circular aperture – amplitude& intensity distribution (final expressions only)

07. Circular aperture- airy pattern, resolution by circular apertures.

08. Diffraction grating- reflection, traasnussion , amplitude & phase gratings(definitions in brief) Grating dispersion &dispersue power, spectral resolution; zone plates.

Polarization & Crystal Optics:

01. Concept of polarization , linear , circular , elliptical polarization (qualitatively), Plane of polarization & vibration, degree of polarization, polarizes, analyzers, Production of polarized light, birefringence, calculate crystal , veal prism, Wallastonprism , retarders - full, half & quarter wave plates, analysis of light of unknown Polarization.

02. Linear Scattering- Raleigh &Mce

03. Principles of LASERs

04. Holography – basic principle; simple experimental arrangement, some applications.

IX. ENVIRONMENT & ECOLOGY

01. General
Introduction, components of the environment, environment degradation.

02. Ecology
Elements of Ecology; Ecological balance and consequences of change, principles of environmental impactassessment.

03. Air Pollution and Control
Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primaryand secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.

04. Water Pollution and Control
Hydrosphere, natural water, pollutants: their origin and effects, river/lake/ground water pollution, standards andcontrol.

05. Land Pollution
Lithosphere, pollution (municipal, industrial, commercial, agricultural, hazardous solid wastes); their origin andeffects, collection and disposal of solid waste, recovery and conversion methods.

06. Noise Pollution
Sources, effects, standards and control.

X. MICROBIOLOGY & PATHOLOGY (General & Ocular)

01. Microbiology

i). Bacteria: Cell structure, elementary idea about classification and morphological basis. Staining reactions: Gramstaining, spore staining, acid fast staining. Bacterial growth: nutritional requirements, physical factor affecting,culture media, and growth curve. Elementary idea about bactericidal agents: Phenol, alcohol.Sterilization(principles, types & methods). Pasteurization. Antibiotics: Bacteriostatic and bactericidal effects.

ii). Virus: elementary knowledge of viral-morphology, viral genome and classification, viral replication. Herpesviruses, hepatitis viruses, miscellaneous viruses, human immunodeficiency viruses. Microbial growth & death, Laboratory culture, host pathogen interactions, antimicrobial hemotherapy,pathogenic mechanisms common to external ocular infections process – clinical pathology.Physiology, pathology, treatment & epidemiology of infectious diseases caused by bacteria, virus, fungi &parasitic organisms with emphasis to disease with ocular manifestations & infectious eye diseases in hot climate asin India. AIDS & eye.

02. General Pathology

Structure & function of immune system – Structure and function of thymus, spleen & red bone narrow- Immunity& its types , plasma proteins & immune reaction, cells involved in immune system. Humoral immunity theories ofantibodies formation.Structure & function of lymph nodes. Structure & function of thymus, spleen & red bonenarrow. Non specific immunity, Antibody mediated immunity, specific immunity, cell modified immunity, Activeimmunity, Passive immunity.
The acute inflammatory reaction – changes in acute inflammation, changes in the calibre of the blood vessels,changes in blood flow, changes associated with exudation. Local sequelae of acute inflammation. The chemicalmediators of acute

03. Inflammation & Repair:

Inflammation.Role of the mast cell in inflammation.Role of the platelets in inflammation. Chronic inflammation– cause, classification, general features.Source of infection.Transmission of organisms to the body.wound infections. Wound healing.Immuno-pathogenesis – type I, II, III & IV hypersensitivity. Mechanism of autoimmunity.Organ specific & nonorgan specific auto immune disease.The HLA system – histocompatibility complex.Pyogenic & bacterialinfection.Gralt rejection-basic outline.Disorder of growth – metaplasia, dysplasia, neoplasia.Circulatory disturbances – thrombosis, infarction, ischemia,embolism.Degeneration (calcification).

XI. OPTICAL & OPHTHALMIC INSTRUMENTATION & PROCEDURE I

01. Detailed study of the Principles of operation, types, optical properties, constructions, adjustments andapplications of the following Instruments and Devices:

02. Binoculars, telescopes and projectors.

03. Simple and Compound Microscopes (with Huygens and Ramsden Eye pieces and oil immersion objectives).Spectrometer.

04. Radiuscope

05. Retinoscopes

06. Standard Tests Charts.

07. Autorefractometer- subjective and objective types

08. Opthalmoscopes- direct and indirect types.

09. Refractometers- Auto refractors, Dioptron

10. Slit lamp Biomicroscope

11. Keratometer

12. Lensometer

13. Trial case lenses-best forms.

14. Trial frame design.

15. Cross cylinder.

XII. VISUAL OPTICS (OPTICS III)

01. Review of Geometrical Optics: From Geometrical Optics.

02. Schematic and reduced eyes and their properties.

03. Optical constants of the eye and their measurement. Purkinje images. Corneal curvature and thickness.Keratometry and pachometry. Indices of aqueous and vitreous.

04. Optical Defects of the Eye- Shape of Cornea, Shape & RI of the lens, Optical axis, Visual axis (angle alpha,Fixation axis (angle gamma), Aberration of the Optical system of eye, Depth of focus, Diffraction &resolving power.

05. Emmetropia and ametropia, Axial versus spherical ametropia, Myopia Hypermetropia(Hyperopial)Astigmatism.

06. Accommodation- possible mechanism of accommodation- Schiener disc experiment- theories ofaccommodation- modern theory- changes in the lens during accommodation- the amplitude ofaccommodation- the measurement of the amplitude n of accommodation- depth of field, luminance and blurtolerance- amplitude of accommodation versus age.

07. Presbiopia-near vision addition- estimate of addition-unequal near vision addition- effect of changing thespectacle distance – hypermetropia and accommodation.

XIII. LIGHTING & THE EYE

01. Eye and Vision: Spectroradiometric curve- V□□-□□curve- photopic and scotopic vision CIE standard observes.

02. Photometric quantities and units- Luminous Flux, Lumen- Illuminance, lux Luminous intensity, Candela –Luminance, Candela/m2. Inverse square law and Cosine law of illumination (Illuminance)

03. Photometry- LumerBrodhum photometer, Guild Flicker photometer- Photocells photo multipliers –photodiodes-noise in physical photometers. Determination lighting of Polar curve of lamps.

04. Calculation- Application of inverse square law and Cosine law- Matt surfaces- Lumen method of lightingdesign – utilization factor, light loss factor, Glare and glare index- disability glare- discomfort glare- controlof glare- contrast

05. Light sources- Special energy distribution- luminous efficacy- color rendering properties- Flicker contracts-Daylight, its properties- color lamp – Incandescent lamps - low pressure Hg-lamps- High pressure Hglamps-Low-pressure NA- lamp- High pressure NA-lamps- Typical applications.

06. Lighting Installation- Luminaries their design function up lighting – down lighting mounting position- Choiceof lighting equipment- lighting system management.

07. Recommended level of illuminance for various including those in optometry and ophthalmology driving etc.

08. VDU- Design of work station – Flicker color contrast- Regulations regarding the use of VDU.

09. Eye Protectors- their constructions standard relating to eye protection

XIV. PHARMACOLOGY (General & Ocular)

01. General Pharmacology:

i). Nature & Sources of drug. Routes of drug administration (general & Ocular). New drug delivery systems.Absorption & Bio availability of a drug.Distribution of a drug.Fate of a drug.Drug excretion & toxicity.Pharmacokinetics of drugs.

ii). Drug action→site of drug action, structure activity relationship. Drug receptor.Mechanism of action of adrug.Dose response relationship. Adverse drugs reactions (ADR) in man, Manifestations of ADR. Treatmentof Acute drug poisoning. Factors influencing drug metabolism & drug action.Classification of drugs.

iii). Drug action on the nervous system→□General Considerations. Aliphatic Alcohol's.General Anesthetics.Sedatives, Hypnotics and Pharmacotherapy of Insomnia.Drugs Effective in Convulsive Disorders.OpioidAnalgesics. Analgesic – Antipyretics and Nonsteroidal Anti- inflammatory Drugs(NSAID). Central NervousSystem Stimulants.Local Anesthetics→□Cocaine, Procaine and Other Synthetics Local Anesthetics.Autonomic Nervous System →□General Considerations.Adrenergic and Adrenergic Blocking Drugs.

02. Ocular

i). Preparation and packaging of ophthalmic drugs
ii). Drug action and effectiveness
iii). Ocular penetration
iv). Ophthalmic diagnostic drugs.
v). Topical anesthetics
vi). Ophthalmic Drugs – antibiotics, corticosteroids, anesthetics, viscoelastics agents. Antiglaucomic drugs.

XV. VISUAL OPTICS (OPTICS IV)

01. Correction of ametropia

02. Correction of myopia- spectacle refraction (F) – ocular refraction(K) – Relationship between F and K.correction of hypermetropia- the effect of vertex distance change. Correction of ametropia with Thick lenses.Some problems involving K.

03. Clear and blurred images in the reduced and simplified schematic eyes. The visual axis. Pupil size and blurdisc diameter. Depth of field .retinal image size in uncorrected reduced eye. Spectacle magnification inreduced and corrected eyes. Nodal points and clear image size. Retinal images with a near object. Spectaclemagnification in near vision. The simple magnifier. Relative spectacle magnification. Correction of sphericalampetropia with contact lens. Spectacle magnification with a contact lens.

04. Ammetropia in the actual human eye. The growth of the human eye in emmetropia. Spherical ametropia inadult eye. Genetic aspects of refractive error. Summary of the causative factors involved in ametropia .Progressive myopia. Juvenile stress myopia.

05. Aphakia. Reflective error in aphakia. The retinal image size in aphakia. Correction of aphkia by a contactlens. Use of an intracocular implant. Power of the implant and retinal image size. Clinical aspects of aphakia.

06. Astigmatism.→Oblique astigmatism. Astigmatism in the reduced eye. Th retinal images of point andextended objects. Classification of astigmatism. Correction of astigmatism by sphero- cylindrical, toric andcontact lenses.

07. Retinoscopy – principle and use. Clinical recording of standard of vision-visual acuity.

08. Review of subjective refractive methods. Problem of review of objective refractive methods Crosscylindricalmethod of detecting astigmatism

09. Eye as an imaging instrument. Schematic eyes. Diffraction and the eye. Image formation in wave optics.Aberrations of the lens and cornea. Chromatic aberration of the eye. Optical performance of the eye. Totalperformance of the eye. Variation of visual performance with focus. Contrast sensivity of the eye.

XVI. OPTHALMIC LENS & DISPENSING OPTICS

01. Ophthalmic lens :

i). Characteristics of lenses:

Introduction. Spherical lenses. Plano-cylindrical lenses. Sphero-cylindrical lenses. Designation of lens power.Power of lenses.Transposition. Write the prescription. Base curve of spherical lens.Base curve of cylindrical single vision lens.Aberration of lens.Prism prescription.Prism effects in a lens.Neutralization.

ii). Spectacle lenses:

Characteristics of lens materials. Specific gravity (weight). Refractive index.Abbe number.Impact resistance.Scratch resistance.Curve variation factor.

iii). Current materials:

Crownglass.CR-39. High –index glass. High –index plastic. Poly carbonate.Photochromatic materials.

iv). Lens types:

Single vision lens. Bi-focal lenses. Tri-focal lenses. Vocational & occupational multifocal progressivelenses.

v). Introduction of bi-focal lenses:

History of bi-focal lenses.Modern bi-focal designs.Types of bi-focal designs.Glass tri-focal lenses.Invisible multi-focal Double segment lens.Plastic bi-focals.

vi). Opthalmic lens coating:

Anti-reflecting coatings.Special notes concerning anti-reflecting coatings.Protective coating, colorcoating.

vii). Absorptive lenses:

Classification of lens tints. Chemical that produces color& assist in absorptive characteristics of glasslenses. Effect in prescription on lens color.Availability of tinted lenses.

viii). Impact resistant lenses:

Types of impact resistant lenses. Plastic lenses. Impact resistant Dress-Eye wear lenses. Tempered glass lenses.Types of impact resistant lenses most beneficial of specific patients.

ix).Lens for special uses:
Fresnel lenses. Thinlite lenses. Lenses for the Aphakic patient. Aspheric lenses.

x). Lens surfacing & quality. Principles of lens surface generation. Glass assessment.Faults in lensmaterials & lens surface.Inspection of lens quality.

02. Basics of dispensing:

1.Spectacle frame
Current frame materials:
a) Plastics
b) Metals
Frame types:
a) Combination of frames
b) Half-eye frames
c) Mounts
d) Nylon-cord frame
e) Special purpose frames.
2.Frame measurements:
a) The boxing system
b) The datum system
c) Comparison of the two systems
d) Lens position
e) Segment specification
3.Frame Selection:
a) Fashion
b) Function
c) Feel
d) Conflicting needs
e) Price
f) Standard alignment
4.Lens Selection:
a) Ground rule for selection
b) Selection criteria
5.Facial Measurement:
a) The PD
b) Visual axes
c) Measuring inter papillary distance
d) Using PD ruler
e) Common difficulties in measuring PDs
f) Measuring monocular PD
g) Measuring near PD
6.Measuring heights:
a) Single vision
b) Multi focal
c) Bi-focal
d) Progressive
7.Pediatric Dispensing:
a) The changing image of spectacle
b) Age differences.
Frame Selection
a) Technical Criteria
b) Fashion criteria
c) Some tips on selection
Lens Selection
Technical criteria

a) Communicating with kids.
b) The kids corner

Facial measurement of the kids
a) PDs
b) Centers
c) Bi-focals
8.Dealing with problems:
a) Dealing with clients
b) Common client problems
c) Dealing with professional colleagues
d) Dealing with the laboratories
9.Special needs dispensing:
a) Occupational dispensing
b) Hazards in the work place
c) Occupational health safety legislation
d) Common hazards.
10.Eye protection:
a) Industrial eye protection
b) Sport
c) Standards covering eye protection
d) Lens materials & impact resistance
e) Frame & eye protection.

XVII. OCULAR DISEASE -I (Anterior Segment Disease)

01. Anterior segment ocular diseases involving orbit, eyelids, adnexa, conjunctiva, cornea, urea, sclera,anterior chamber, iris and lens. Symptomatology, clinical signs, diagnosis, pathogenesis,pathophysiology , systemic disease relationships and treatment of degenerative, infections andinflammatory conditions affecting these structures.

02. Disease of the Lids – Congenital Deformities of the Lids .Oedema of the Lids. Inflammatory Conditions of the Lids.Deformities of the Lid Margins.Deranged Movement of the Eyelids. Neoplasm's of the Lids. Injuries of the Lids.

03. Diseases of the Lachrymal Apparatus-. Dry Eye. Disease of the Lachrymal Gland. Disease of theLachrymal Passages. Operations for Chronic Dacryocystitis.

04. Disease of the Conjunctiva- Subconjunctival Haemorrhage Infective Conjunctivitis. FollicularConjunctivitis. Granulomatous Conjunctivitis. Allergic Conjunctivitis. Conjunctivitis Associatedwith Skin conditions. Degenerative conditions of the Conjunctiva. Vitamin- A Deficiency. Cysts andTumours of the Conjunctiva. ConjunctivalPigmentation . Injuries of the Conjunctiva.

05. Disease of the Cornea –Congenital Anomalies. Inflammation of the Cornea (Keratitis). SuperficialKeratitis. Deep Keratitis. Vascularisation of Cornea. Opacities of the Cornea. Keratoplasty. CornealDegenerations. Corneal Dystrophy's. Corneal Pigmentation. Corneal Injuries. Refractive CornealSurgery. Corneal Ulcer (Bacterial , Viral , Fungal)

06. Disease of the Sclera- Episcleritis. Scleritis. Staphyloma of the Sclera. Blue Sclerotic ScleromalaciaPerforms. Nanophthalmos. Injuries of the Sclera.

07. Disease of the Iris.-. Congenital Anomalies. Inflammations (Anterior Uveitis) . Specific Types ofIriodocyclitis . Degenerations of the Iris. Cysts and Tumours of the Iris. Injuries of the Iris.

08. Disease of the Celery Body- Inflammations of the Celery Body. Purulent Iriodocyclitis (Panophthalmitis) .Evisceration .Sympathetic Opthalmia.Vogt- Koyanagi – Harada Syndrome.Tumours of the Celery body.Injuries of the Celery body.

09. Glaucoma- .Formation of Aqueous Humor. Drainage of Aqueous. Intraocular Pressure(IOP).Ocular Rigidity.Tonography. .Developmental Glaucoma (Buphthalmos) . Primary Narrow Angle Glaucoma. PrimaryOpen Angle Glaucoma. Normotensive Glaucoma . Ocular Hypertension . Secondary Glaucoma.Surgical Procedures for Glaucoma(Steps Only) ,YOGPI ,trabeculectomy.Laser Procedure in Glaucoma .Artificial Drainage Devices in Glaucoma Surgery(Molteno).

10. Disease of the Lens- Congenital Malformations. Cataract . Congenital and Developmental Cataract. Senile Cataract. Traumatic Cataract. Complicated Cataract. Secondary Cataract . After Cataract.Dislocation of the Lens. SurgicalProcedures for Removal of the Lens(Operative Steps Only).Phacoemulsification(ICCE,ECCE,IOL) . Small Incision Cataract Surgery (Manual Phaco).IntraocularLens Implantation-AC+PC, IOL.

XVIII. CLINICAL REFRACTION –I

1. Ophthalmic Case Historian: Demographic data, chief complaints, secondary complaints, ocularhistory, medical history, drugs and medications, family ocular history, family medical history, social history, review of system, few example of history writing.

2. Recording Visual Acuity: Distance – Snellens and log MAR. near-points/'M'/RS, use of Baily-lovieword reading chart.

3. Objective Refraction: Streak Retinoscopy – all procedures to use streak retinoscope; static anddynamic retinoscopy, different methods of dynamic retinoscopy – MEM, Nott's, Sheard's, Low and high neutral, Bells, Cross, Taits. Other methods of retinoscopy-Radical, Near(Mahandra), Chromoretinoscopy, String Lensbar, use of objective and autorefractor.

4. Subjective Refraction: Monocular Distance – Classic fogging, testing of astigmatism under fog fixedastigmatic dial (clock dial), rotary astigmatic dial, combination of fixed and rotary dial (Fan and Block test), J.C.C. Duochrome or Bichrome, Binocular balancing – alternate occlusion, prism dissociation, dissociated duochrome balance, Borish dissociated fogging, equalization

5. Binocular Distance – T.I.B. (Turville Infinity Balance), Polarized – Target and polarized filter, fogging. Near subjective refraction.Cycloplegic refraction, cycloidemia, sudden unfogging ,Borish delayed spherical end point, pinhole estimation of refractive error, stenopaic slit refraction, measurement of vertex distance, distometer, use of subjective autorefractor. Different methods of measuring amplitude of accommodation.Correction of Presbyopia – Different methods of stimulation of tentative presbyopic addition – amplitude of accommodation, J.C.C., NRA-PRA balance, Bichrome, Plus Build-up, based on age, Dynamic retinoscopy. Occupational consideration, finalization of odd for near and intermediatedifferentoptions of correction. Measurement of IPD and significance.Final discussion with the patient.Writing prescription of power and counselling

XIX. OPTICAL & OPHTHALMIC INSTRUMENTATION & PROCEDURE –II

Principles, clinical use (methods) & significance of following instruments:

01. Tonometer – Principles, types, clinical importance as a routine procedure (application)

02. Pachometer – Principles, types, clinical importance

03. Devices for colorvision testing – CS testing / Glare testing.

04. Ultrasonography – (A scan, B scan) – Principles and application.

05. F.F.A – Principles and demonstration of film.

06. PAM – Principles and importance.

07. Perimeter – Basics of perimetry – Humphray instruments, Automated perimetry – basics, types(names),interpretation of normal Glaucoma Field of Definition.

08. LASER – Introduction – Einstein co-efficient, population inversion.Different types of LASER (mention) – Excimer, LasikNd-yag, Argon, Diode, He-Ne gas LASER, Xenon.
LASER safety, Ophthalmic LASER application(Argon, Yag)

XX. OCULAR DISEASE II
(Posterior Segment &Neuro-ophthalmic Disease)

01. Diseases of the Vitreous Humor- Congenital Anomalies. Vitreous Opacities. Hereditary Vitreo – RetinalDegeneration's. Vitreous Haemorrhage .Detachment of Vitreous Humor . Vitreous Surgery .

02. Methods of clinically assessing the posterior segment (direct & indirect opthalmoscopy)

03. Disease of the Retina- Congenital & Dev. Defects. Inflammation of the Retina(Retinitis) . Retinal Vasculitis .Oedema of the Retina. Haemorrhage of the Retina. Vascular Occlusion . Retinal Arteriosclerosis.Retinopathies . Retinal Telangiectasis. Degeneration's of the Retina. Detachment of the Retina. SurgicalProcedures for Retinal Detachment .Tumours of the Retina. Phakomatoses,.Injuries of the Retina.

04. Disease of the Optic Nerve- Congenital Anomalies. Papilloedema. Inflammation of the Optic Nerve(Optic-Neuritis). Ischaemic Optic Neuropathy . Optic Atrophy. Tumours of the Optic Nerve. Injuries of the OpticNerve.

05. Symptomatic Disturbances of Visual Function – Visual Field Defects . Amblyopia. Amaurosis. Night
Blindness.Day Blindness.Defects in Color Vision.Congenital Word Blindness.Malingering.

06. Neuro –eye disease:
i). Evaluation of optic nerve disease
ii). Clinical features of optic nerve dysfunction., Optic disc changes. Optic atrophy.Special investigation.
iii). Classification of optic neuritis
iv). Optic neuritis and demyelination
v). Systemic features of multiple sclerosis, Special investigation. Optic neuritis.
vi). Other causes of optic neuritis
vii). Parainfectious optic neuritis. Infectious optic neuritis.
viii). Non-arteritic anterior ischaemic optic neuropathy

ix). Arteritic anterior ischaemic optic neuropathy
x). Clinical features of giant cell arteritis. Special investigation.Arteritic anterior ischaemic optic neuropathy.
xi). Leber hereditary optic neuropathy
xii). Hereditary optic atrophies
xiii). Kjer syndrome. Behr syndrome.Wolfram syndrome.
xiv). Alcohol-tobacco amblyopia
xv). Drug-induced optic neuropathies

07. PAPILLOEDEMA
Raised intracranial pressure - Causes.Hydrocephalus. Systemic features. Clinical features of papilloedemaDifferential diagnosis.

08. CONGENITAL OPTIC NERVE ANOMALIES
Without neurological associations
i). Tilted disc.
ii). Optic disc drusen.
iii). Optic disc pit.
iv). Myelinated nerve fibers.

With neurological associations
Optic disc coloboma.
i). Morning glory anomaly.
ii). Optic nerve hypoplasia.
iii). Aicardi syndrome.
iv). Miscellaneous anomalies.

09. PUPILLARY REACTION
Applied anatomy.
Abnormal pupillary reactions
i). Afferent pupillary conduction defects
ii). Argyll robertson pupils
iii). Differential dignosis of light-near dissociation
iv). Adie pupil
v). oculosympathetic palsy (horner syndrome)

10. NYSTAGMUS
Classifications
Causes
i). Physiological nystagmus.
ii). Motor imbalance nystagmus.
iii). Ocular nystagmus.
iv). nystagmoid movements.

11. SUPRANUCLEAR DISORDER OF EYE MOVEMENTS
Conjugate eye movements
i). Saccadic movements.
ii). Smooth pursuit movements.
iii). Non-optical reflexes.
Supranuclear gaze palsies
i). Horizontal gaze palsies.
ii). Vertical gazepalsies.

12. THIRD NERVE DISEASE
Applied anatomy
Clinical aspects
i). Clinical features.
ii). Aberrant regeneration.
iii). Causes isolated third nerve palsy.

13. FOURTH NERVE DISEASE
Applied anatomy
Clinical aspects
i). Clinical features.
ii). Causes of isolated fourth nerve palsy.

14. SIXTH NERVE DISEASE
Applied anatomy
Clinical aspects
i). Clinical features.
ii). Causes.

15. DISORDERS OF CHIASM
Classification
Applied anatomy
Applied physiology
i). Hyperpituitarism.
ii). Hypopituitarism.
Pituitary adenoma
i). Clinical features.
ii). Special investigation.
iii). Treatment.
Craniopharyngioma
Meningioma

16. DISORDERS OF RETROCHIASMAL PATHWAYS AND CORTEX
Clinical features of optic tract lesion
Lesions of optic radiations
i). Applied anatomy.
ii). clinlcal features.
Lesions of striate calcarine cortex
Migraine
Clinical features
Management

17. OCULAR MYOPATHIES AND RELATED DISORDERS
Myasthienia gravis
i). Clinical features.
ii). Special investigations.
iii). Treatment.
Ocular myopathies
Myotonic dystrophy
i). Systemic features.
ii). Ocular features.
Essential blepharospasm
i). Clinical features.
ii). Treatment.

18. NEUROFIBROMATOSIS
Neurofibromatosis type-1(NF-1)
i). Systemic features.
ii). Ocular features.
Neurofibromatosis type-2(NF-2)

XXI. BINOCULAR VISION & OCULAR MOTALITY

01. Grades of binocular vision-simultaneous perception (first grade of binocular vision), fusion, steropsis (third gradeof binocular single vision). Advantages of binocular vision. Visual direction and the horoptervisual direction,corresponding point and normal retinal correspondence, horopter, physiologic diplopia. Binocular fusion-panum'sarea,fixation disparity,theories of binocular fusion,synergy hypothesis of panum,local sign hypothesis ofhering,eye movement hypothesis of helmholts,suppession hypothesis of du tour and verhoeff,physiologic basis offusion.

02. Dihoptic stimulation-depth with fusion and depth with diplopia,diplopia without depth,retinal rivary andsuppretion,binocular lusure. Stropsis-physiologicalbasis of stereopsis,local and global stereopsis andfusion,stereopsis acuity neurophysiology of stereopsis.Depth perception-steropsis,nonstereoscopic cluesto the perception of depth under binocular condition,monocularclues (non stereoscopic clues to spetial orientation)-parallactic movements, linear perspectiveoveriay ofcontours,size distance from horizon,distribution of highlights, shadow, shades and light .aerial perspective,influence of accommodation and convergence on depth perception, conclusion. Integration of the motor andsensory system into binocular vision.

03. Binocular defects:

Binocular optical defects-anisometropia-vision in anisometropia,treatment, Binocular optical defects-aniseikoniasymtoms, clinical investigatoin,treatment.Binocular muscular co-ordination-orthophoria-binocular vision.Binocular muscular anomalies-heterophoria-the causes of imbalance,exophoria, esophoria, hyperphoria, cyclophoria, symptoms of heterophoria, treatment.Binocular muscular anomalis-heterotropia—the vision in concomitant strabismus, treatment.Binocular muscular co-ordination-convergence-voluntary and reflex convergence, reflex convergence, the measurement of convergence, the relation between accommodation andconvergence, binocular accommodation, fatigue of convergence.Binocular muscular anomalies-anomalies of convergence and other reading difficulties—insufficiency of convergence, convergence excess, the ophthalmologist and the reading ability of children.

04. BINOCULAR VISION TEST:

Test for simultaneous macular perception, test for fusion, test for stereopsis-synoptophore or stereoscope test,vectograph test, titmus stereo test,randomdotsterogram test,simple motor task test based on stereopsis. Eye movements: the orbit anatomy of the extraocular muscles. Interactive dynamics of orbital mechanisms &brain stem neurophysiology – out line of extra ocular muscle control. 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 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 vengeance), Supra nuclear control of eye movements.(the superior colliculi, the occipital cortex, the psycho optical reflexes & fixation. Oculomotor system: vestibular – ocular reflexes, optokinetic reflexes. Diagnosis & clinical aspects of ocular anomalies & disorders. Converge through a spectacle lens. Prismatic effects in spectacle lenses.

XXII. CONTACT LENS - I

a) Contact lens history & development. Benefits of contact lens over spectacle. Manufacturing methods-spin cast, Lethe cut, Cast modeling.
b) Slit lamp Examination technique
c) Corncal topography- Keratometry& Extended Keratometry
d) Contact lens optics-Contact lens & spectacle lens. Back vertex calculation. Contact lens & Tearlens system.
e) Classification of contact lens & its material (soft& RGP); Material property.
f) Contact lens terminology. RGP & soft lens design. FDA classification of contact lens material.
g) Patient selection &prescreening. Indications & contra indications of contact lens.
h) Soft spherical contact lens fitting &Assesment.
i) Soft contact lens case & maintenance.
j) Spherical RGP contact lens fitting & assessment.
k) RGP contact lens care & maintenance.

XXIII. LOW VISION AID & VISUAL REHABILITATION

a) Definition-old, new, proposed
b) Grades of low vision
c) Statistics/ Epidemiology
d) Relation between disorder, impairment & handicapped
e) Low vision optics
Magnification-relative distance/ relative size/ approach/angular
Optics of Galilian&Keplarian telescope- advantage/disadvantage, significance of exit & entrance pupil.Optics of spectacle magnifier/ determination/ calculation/ disadvantage/advantage.Optics of stand magnifier, significance of equivalent viewing distance & calculations.Telescope- distance/ near/ telemicroscope/ monocular/ binocular/ bioptic. Determination of decentration of lenses /prism/calculation/Lebenson's formula/simple diotric formula.Hand held magnifier-illuminated/ non-illuminated. Spectacle magnifier / half eye/ prism correction/ bar magnifier/ CCTV/ magni-cam/ lowvision imaging system or V-max / contact lens & IOL telescope.
f) Low vision examination:
Task/ Goal oriented history-medical/ visual/ psychological history/ task analysis/ mobility/ distance vision/ near vision / daily living/ illumination/ work & school.Visual acuity measurement-distance/ near/ use of log MAR chart (distance& near)/ lighthouse, picture chart/ visual field/ Amsler chart/ contrast sensitivity/ overview of glare testing.
Low vision refraction.
g) Assessment & prescription of low vision devices-optical/ non-optical/ rehabilitation services. Non- optical devices-pen/umbrella/ boldline note book/ illumination/ letter writer/ environmental modification/ signature guide/ needle threader/ eccentric viewing strategies.
h) Overview of Rehabilitation Services:- definition/ implementation/ vocational guidance/ educational guidance/ mobility & orientation training / special teacher/ special school/ Braille system/ integrated system/referral center- activity/ support/ loan.
i) Overview of systematic / retinal diseases in relation to low vision:-acromatopsia/ LMBB syndrome/ labers congenital anomaly/ down syndrome/ retinitis pigmentosa/ diabetic retinopathy/ optic atrophy/ albinism/ aniridia.
j) Counseling of low vision patient/ parents/ guardians/relatives.

XXIV. CLINICAL REFRACTION - II

Clinical Refraction –II
(Geriatric &Pediatric Optometry)

a) Assessment of children Vision & Paediatric evaluation, diagnosis & management.
b) Strabismus &Aniblyopia.
c) Non- StrabismicBiuoculan Disorders.
d) Neuro- Optometric Rehabilitation.
e) Evaluation, Diagnosis & Optometric management of children with mental retardation C.P. Dyslexia,Multiple Sensory Motor Haudicap.
f) Visual Disorders in senior citizens, evaluation, diagnosis+ management.
g) Sports vision.
h) Refraction in special cases (pseudophakia , aphakia, irregular corneal astigmatism , coloboma of iris,choroids, retina, nystagmus, post R.K., PRK, LASIK)
i) Congenital cataract, glaucoma.
j) Patient with low vision.
k) Patient with anisometropia(Anisokonia)
l) Monocular & binocular subjective refraction.

XXV. SYSTEMIC CONDITIONS & THE EYE

1. Arterial Hypertension
i) Pathophysiology, classification, clinical examination, diagnosis, complications, management.
ii) Hypertension and the eye.
2. Diabetes mellitus
i) Pathophysiology, classification, clinical features, diagnosis, complications, management.
ii) Diabetes mellitus and the eye.
3. Acquired Heart Disease – Embolism
i) Rheumatic heart disease
ii) Subacute bacterial endocarditis.
iii) Heart disease & the eye.
4. Malignancy
i) Definitions, nomenclature, characteristics of benign & malignant neoplasms.
ii) Grading and staging of cancer, diagnosis, priniples of treatment.
iii) Neoplasia and the eye.
5. Connective Tissue Disease
i) Anatomy and pathophysiology: Arthritis.
ii) Eye and connective tissue disease.
6. Thyroid Disease
i) Anatomy and physiology of the thyroid gland.
ii) Classification of thyroid disease
iii) Diagnosis, complications, clinical features, management of thyroid disease involving eye.
7. Tuberculosis
i) Etiology, pathology, clinical features, pulmonary TB, diagnosis, complications, treatment of tuberculosis involving the eye.
8. Tropical Disease and the Eye
i) Leprosy.
ii) Syphilis.
iii) Malaria.
9. Vitamin deficiency and the eye
10. Neurological disease and the eye
i) Classification of neurological diseases.
ii) Demyelinating diseases
iii) Visual pathway lesions
iv) Papiloedema.

11. Genetic disorders and the eye.
12. Phacomatoses& the eye.

XXVI. PUBLIC HEALTH & COMMUNITY OPTOMETRY

1. Concept of public health.
2. Principles of primary, secondary and tertiary care.
3. Planning of health services.
4. Health economics
5. Health manpower development-a)Basic O.T Practices
b) Familiarity with use of Operating Microscope
6. NPCB and refractive blindness – optometrist's role as primary health care provides.
7. Health cares insurance including role of TPA.
8. Ocular emergencies –
a) Foreign body
b) Eye Pain
c) Watering
d) Injuries-perforating, non perforating& chemical

XXVII. BIOSTATISTICS

1. Introduction about Biostatistics, variables, data, population sample, parameter statistics, scales ofmeasurement.

2. Classification & Presentation of data: Frequency distribution, Frequency polygon, Bar diagram, Histogram,Frequency distribution curve, CF & CP, Ogive, Percentile & Quartiles.

3. Descriptive statistics: Statistics of location, Mean Median Mode, Geometric mean, Range, Statistics ofDispersion, Mean Deviation, Standard Deviation, Coefficient of Variation. Correlation & Regression.

4. Sampling Statistics: Sampling & Sampling Distribution, Sampling Errors & sampling statistics, Standarderrors, Degree of freedom, Types of Sampling.

5. Probability Distribution: Classical definition, Conditional probability, Probability in continuous, Jointdistribution of random variables.

6. Experimental Design: Controlled and uncontrolled experiment, Sampling types, Sample size & pilotexperiment, Single factor experiment & Factorial experiment-example, Analysis of variance (ANOVA).

7. Applications: Collection, presentation and analysis of hospital statistical data with examples. Collection,presentation and analysis of Optometric and ophthalmologic data with a few examples.

XXVIII. CONTACT LENS – II

1. Contact lens fitting in astigmatism.
2. Contact lens fitting in keratokonus.
3. Contact lens fitting in children.
4. RGP lenses – low D.K. and high D.K. lenses.
5. Instructions regarding handling and care of lenses.
6. Cosmetic and prosthetic contact lenses.
7. Extended wear lenses versus Daily wear
8. Disposable lenses
9. Contact lens – Toric, Bifocal, Multifocal.
10. Therapeutic lenses / Bandage lenses.
11. Contact lens solutions – principle of action, compositions
12. Ordering contact lenses – writing prescription to the lab.
13. Contact lens – modifications of finished lenses (RGP).

14. Checking the parameters.
15. Recent advances in contact lenses.
16. Follow up examinations
17. Contact lens complications and their management.
18. Prosthetic eye fitting procedures & conformers.

XXIX. PROFFESIONAL PRACTICE MANGEMENT

1. Law & Optometry
i). Laws governing medical and paramedical professions
ii). Consumer act with respect to optometry and dispensing of optical Aids.
iii). nternational optometry.
iv). Personal and professional insurance (indemnity).
v). Employment and contacts.
vi). Partnership and alternatives.
vii). Ethics.
viii). Negligence.

2. Basic Accountancy and Public relations
i). Introduction.
ii). Terms used in accounts, Principles of accountancy.
iii). Journal & ledger
iv). Trial Balance
v). Subsidiary books, petty cash book, sales register, purchase register, stock register
vi). Bank reconciliation and Banking procedures.
vii). Depreciation.
viii). Balance sheet and profit & loss accounts.
ix). General ideas about Income tax and sales tax.
x). Project report and financial inability.
xi). Costing in practice (Buying, stock-keeping,assesment of fees and costing of appliance).

Public relations.
i). Definitions.
ii). PR- its disfunction from publicity, propaganda & advertising.
iii). Internal and external aspects of PR
iv). Phases of PR: analysis building, promotion of product or services, better employee, government andcommunity relation.

3. Methods of public relations:
i). Press relations: Press release, Press conference, and Letter to editor.
ii). Printed work: Style, colour & design.

4. Case Study:- (at least ten Cases) as per format

XXX. APPLIED OPTOMETRY AND ORTHOPTICS

1. ORTHOPTIC INSTRUMENTS
♦Prism Bar
♦Synoptophore
♦Maddox Wing
♦Maddox Rod
♦Red Green Goggles
♦Hess Screen
♦Risley Prisms

Investigative procedures
♦Motor signs in squint
A) Head position: Face turn, chin position, Head tilt.
B) Cover test & cover-uncover tests
C) Maddox wing to assess heterophoria.
♦Assessment of degree of squint
a) Hirschbag test.
b) Prism bar test.
c) Krimskey test
d) Synoptophore test
♦Assessment of ocular motality status
a) Hess chart
b) Diplopia testing
c) Bielschowskys Head tilting test
♦Assessment of visual sensory status in squint.
Amblyopia
Suppression
Binocular single vision – SMP, Fusion, Stereopsis.
♦Mechanisms leading to squint
Types of squint –
a) latent / manifest
b) horizontal / vertical
c) paralytic / concomitant

Orthoptic Treatment Procedures

Management of –
i). Convergence insufficiency
ii). Amblyopia
iii). Suppresion
iv). ARC
v). Use of prism -
For Exercise & correction

2. AMBLYOPIA
i). Definition.
ii). Neuropathology.
iii). Classification.
iv). Clinical Features.
v). Treatment.
a) Occlusion.
b) Penalisation.
c) Role of drugs.

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