Bachelor in Ophthalmic Technology

Rules-Regulations & Curriculum

(w.e.f. 2023-24)

REGISTRAR
Sai Tirupati University
Udaipur (Raj.)

PRINCIPAL
VENKATESHWAR INSTITUTE OF
PARAMEDICAL SCIENCES
UMARDA, UDAIPUR

Venkteshwar Institute of Paramedical Sciences

(A Constituent Unit of Sai Tirupati University, Udaipur)

Program of Study & Scheme of Examination

1. TITLE OF THE PROGRAM - The title of the Program shall be "Bachelor in Ophthalmic Technology".

2. DURATION OF PROGRAM /TRAINING - The Program shall be of three years duration 6 semester plus a one-year Internship from the date of commencement of the Program.

3. MEDIUM OF INSTRUCTION - English shall be the medium of instruction.

4. ELIGIBILITY FOR ADMISSION –

• For admission, a candidate must have passed the 10+2 (Senior Secondary) Examination or its equivalent Examination in the Science stream i.e. Physics, Chemistry, and Biology with 50% marks in the aggregate & pass in each subject individually for General Category and 45% for SC/ST/OBC/MBC candidates from a recognized Board or as per Govt. Guidelines.

• Candidate should have completed the minimum age of 17 years as of 31st December of the year of admission.

• Lateral Entry- Lateral entry Admission directly to Second year i.e third semester of a UG paramedical Program should be done from a candidate having diploma in Paramedical Subject of same specialty in addition to entry qualification.

5. CRITERIA FOR ADMISSION - Selection shall be done by an Admission Board of the University/Rajasthan Paramedical Council strictly on merit/written examination.

6. RESERVATION POLICY - Reservations in admissions shall be applicable as per the policy of the State Government.

7. ENROLMENT -

1. Every candidate who is admitted to the Program is required to get himself/herself enrolled with the admitted university after paying the prescribed eligibility and enrollment fees.
2. No student shall be allowed to appear in the university examination without enrollment in the university.

8. MIGRATION RULES -

• No student once admitted to the Program and enrolled by the university, will be permitted to migrate to any other university.

• No student will be admitted to the Program on migration from any other university.

9. ATTENDANCE –

A minimum of 75% attendance is required in each semester, both for theory and practical classes separately. Students with deficient attendance will not be permitted to appear in university examinations.

A student detained due to short attendance will have to repeat the semester.

10. WORKING DAYS - Each academic semester shall consist of minimum 120 working days, including examinations.

11. CONDUCTION OF THE UNIVERSITY EXAMINATION - A university semester examination shall be conducted twice in a year with the interval of six months. Even semester examination shall be conducted after six months of odd semester examinations.

12. ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION - A student is required to have minimum 75 % attendance in theory and practical's separately of each semester to make him/her eligible to appear in the university semester examination.

Candidates failing in one or more subjects (theory/practical) of semester will require to appear in failing subjects in the next examination of same semester.

A candidate will have to clear all the subjects of first to fifth semester before appearing at sixth semester university examination otherwise he will not be allowed to appear in the Part-III sixth semester university examination.

13. APPOINTMENT OF EXAMINER & PAPER SETTER -

a. All the examiners, paper setters, theory examination answer book evaluators, external and internal examiners for practical examinations shall be appointed by the respective university.

b. Professor/ Assoc. Professor/ Assistant Professor/Lecturer/Paramedical Professional having PG qualification and 3 years professional/teaching experience after PG in respective fields is eligible to act as an internal or external examiner of theory/practical examination.

14. SCHEME OF EXAMINATION - The University examination for the Program shall be conducted semester wise at the end of every six months.

i. Theory –

(a) There shall be four Theory papers in each semester of study.

(b) Each Theory paper examination shall be of 3 hours duration and a maximum of 80 marks.

(c) Internal assessment (IA) shall be 20 marks for each Theory Paper.

(d) The Paper Setter shall set the questions within the prescribed Program of study of the concerned paper. There will be a set pattern of question papers duly approved by the Academic Council.

Proposed Pattern of question papers –

i. Every question paper shall contain Six questions out of which five need to be attempted.
ii. Question No. 1,3,4 shall be of long answer type. It shall carry 16 marks each.
iii. Question No. 2 shall have two parts carrying 8 marks each.
iv. Question No. 5 shall have four short notes each carrying 4 marks.
v. Question No. 6 shall have four short notes each carrying 4 marks.

(g) Passing Marks: A candidate will have to obtain at least 50% marks in each Theory paper including internal assessment to pass.

ii. Practical and Viva-Voce Examination -

(a) At the end of each semester there shall be the practical and viva-voce examination of 200 marks. It shall be conducted after the Theory examination is over. A candidate will have to obtain at least 50% marks in the practical and viva-voce examinations.

(b) The pattern of practical examination shall be as follows –

Semester	Practical & viva-voce	Internal Assessment	Total Marks	Min. Pass Marks	Practical Examiners
Ist Sem	150	50	200	100	One Internal & one External Examiner
IInd Sem	150	50	200	100	One Internal & one External Examiner
IIIrd Sem	150	50	200	100	One Internal & one External Examiner
IVth Sem	150	50	200	100	One Internal & one External Examiner
Vth Sem	150	50	200	100	One Internal & one External Examiner
VIth Sem	150	50	200	100	One Internal & one External Examiner

The university shall appoint the panel of examiners in such a manner that the complete syllabus of semester is taken care of by the internal/external practical examiner(s).

If the Practical examination consists of more than one subject/department, the Board of studies/ Committee of Program shall decide the distribution of marks of different parts of the practical examination ensuring that the maximum marks of all the parts of the practical examination do not exceed 200 Marks.

iii. Result

1. A candidate will have to obtain at least 50% marks separately in each Theory paper including internal assessment and a minimum of 50% marks in the practical examination for him to be declared pass.
2. A Candidate who has failed in theory paper(s)/ Practical examination will reappear in respective theory papers(s)/ Practical examination in next examination of same semester will held in next year of a subject.

iv. Supplementary/Remanded Examination -

(a) There shall be a supplementary examination of sixth semester only within Six months of the main examination of sixth semester.

(b) Internal assessment marks obtained in the main examination in the concerned failed paper(s)/practical shall be carried forward for working out the result of next Theory paper(s) and/or practical examination.

(c) If the candidate reappearing in the university examination due to failure in subjects then He/She shall be allowed to improve his/her internal assessment marks also or He/she can opt to carry forward his/her earlier obtained internal marks.

v. Promotion to next semester -

1. A candidate who has appeared in the University examination of a semester and has passed it OR failed in one or more subjects shall be promoted to next semester.
2. A candidate will be allowed to appear for the sixth semester examination only when the backlog of all subjects (theory and practical) of first semester to fifth semesters exams including elective papers (if any) is cleared.
3. A student detained due to short attendance will not be promoted to next semester in this case he/she have to repeat the whole semester.
4. The student is required to clear all the University examinations within 6 academic years from the joining of the Program otherwise he/she will have to leave the Program.

15. GRACE MARKS

1. A student who appears in all papers of the examination on the first attempt and obtains the required minimum pass marks in the total aggregate of an examination but fails to obtain the minimum pass marks in one subject (in theory or practical as the case may be) may be awarded the grace marks as per policy of the university up to a maximum of 06 marks, provided the candidate passes the examination by an award of such grace marks.
2. No grace marks will be awarded to a candidate who appears in part/ supplementary examination.
3. A candidate who passes the examination after the award of grace marks in a paper/practical or the aggregate will be shown in the marks sheet to have passed the examination by grace. Grace marks will not be added to the marks obtained by a candidate from the examination.
4. Non-appearance of a candidate in any part of the examination on account of any reason will make him ineligible for grace marks.
5. A candidate who is awarded grace marks in any subject to pass the examination will not be entitled to distinction in any subject.

16. REVALUATION / SCRUTINY - Revaluation of answer book(s) and scrutiny of the marks will be as per policy of the university.

17. TEACHING HOURS - Teaching hours shall be not less than 630 hours in every academic semester.

18. INTERNSHIP –

Every candidate after successful completion of the all-semester examination have to undergo a one-year compulsory rotating internship.

Candidates coming from other institutions with the permission of the Head of the concerned institution will be allowed for the internship program in the respective University after receipt of the fees prescribed by this University. Internships shall be rotating in the concerned department.

Internship Rules:

1. The intern will be eligible for 1-day casual leave each month and can carry over the leave to the next months, but he/she cannot avail of the next month's leave in advance.
2. The interns should conduct themselves in a manner befitting the profession.
3. The intern should dress appropriately in the clinical areas.
4. The intern must wear a white apron with a nametag when in the clinical area/wards.
5. The intern can avail of medical leave on producing a medical certificate but will have to compensate for the number of days of absence from the internship.

Authority for issue of Internship Completion Certificate - The Principal/Director of the college/ Institution shall issue a certificate of successful completion of a one-year internship to each candidate after satisfying that the candidate has completed the training program and has acquired the skills.

19. Award of Degree - The degree shall be awarded by the University only after receipt of the Internship completion certificate from the Principal/Director of the college/ Institution.

20. Log Book –

This predefined task performed by learners that contributes to the achievement, acquisition of the requisite knowledge, skills, attitude and/or competencies of stated objectives should be recorded in log book for the study period.

It includes selected assignments, self-assessment, feedback, work-based and in-training formative assessments, reflections and learnings from planned activity in the curriculum.

21. Skills Enhancement add on Programs/electives –

Students can select any one or more Discipline Specific Elective, Ability Enhancement Program, Generic Elective add-on Program at the beginning of a semester and the candidate will have to pass these add on Program before appearing at the sixth semester examination. The examination of these subjects shall be conducted at the Institute level.The Marks obtained by the candidates in these add-on Program shall be mentioned separately in the mark's sheets of the respective university. These marks shall not be counted for preparing the merit list.

Program Scheme

Semester I

Course Code	Course Name	Evaluation		
		Internal	External	Total
OT101	Human Anatomy & Physiology-1	20	80	100
OT102	Ocular Anatomy, Pathology and Microbiology-1	20	80	100
OT103	Ocular Physiology & Including binocular reflexes and its maintenance-1	20	80	100
OT104	Optics-1	20	80	100
OT105	Practical for all subjects / Clinical Posting	50	150	200

Semester II

Course Code	Course name	Evaluation		
		Internal	External	Total
OT201	Human Anatomy & Physiology-2	20	80	100
OT202	Ocular Anatomy, Pathology and Microbiology-2	20	80	100
OT203	Ocular Physiology & Including binocular reflexes and its maintenance-2	20	80	100
OT204	Optics-2	20	80	100
OT205	Practical for All subjects / Clinical Posting	50	150	200

Semester III

Course Code	Course Name	Evaluation		
		Internal	External	Total
OT301	Pharmacology & Pharmacy-1	20	80	100
OT302	Refraction (including prescription & fitting of Glasses)-1	20	80	100
OT303	Investigative Ophthalmology-1	20	80	100
OT304	Ophthalmic Instruments and Appliances-1	20	80	100
OT305	Practical for All subjects / Clinical Posting	50	150	200

Semester IV

Course Code	Course Name	Evaluation		
		Internal	External	Total
OT401	Pharmacology & Pharmacy-2	20	80	100
OT402	Refraction (including prescription & fitting of Glasses)-2	20	80	100
OT403	Investigative Ophthalmology-2	20	80	100
OT404	Ophthalmic Instruments and Appliances -2	20	80	100
OT405	Practical for All subjects / Clinical Posting)	50	150	200

Semester V

Course Code	Course Name	Evaluation		
		Internal	External	Total
OT501	Clinical & Advanced Optics & Orthoptics-1	20	80	100
OT502	Contact Lenses	20	80	100
OT503	Community Ophthalmology & Eye Camps	20	80	100
OT504	Investigation in Clinical Ophthalmology	20	80	100
OT505	Practical for All subjects / Clinical Posting)	50	150	200

Semester VI

Course Code	Course Name	Evaluation		
		Internal	External	Total
OT601	Clinical & Advanced Optics & Orthoptics-2	20	80	100
OT602	Clinical & Advanced Refraction	20	80	100
OT603	Eye Bank	20	80	100
OT604	Management of OT	20	80	100
OT605	Practical for All subjects / Clinical Posting)	50	150	200

INTERNSHIP – After completion of six semesters of Bachelor in Ophthalmic Technology the candidates will undergo one year internship in a government recognized hospital/Institution as partial fulfilment for the award of Bachelor in Ophthalmic Technology as per government norms.

Detailed syllabus

SEMESTER-I

COURSE NAME: HUMAN ANATOMY & PHYSIOLOGY – 1

COURSE CODE: OT-101

UNIT 1

Introduction to Human Body and Tissues:

Definition and Branches of Anatomy:

Definition of anatomy; types such as gross anatomy, microscopic anatomy, developmental anatomy, applied anatomy, surface anatomy, radiological anatomy.

Levels of Organization:

Hierarchy of biological organization:

- **Cell** – Basic structural and functional unit
- **Tissue** – Group of similar cells performing a specific function
- **Organ** – Structure composed of two or more tissues
- **System** – Group of organs working together for a common function
- **Organism** – Entire living individual

Anatomical Terminology:

- **Planes** – Sagittal, coronal, transverse
- **Positions** – Anatomical, supine, prone
- **Directional Terms** – Anterior/posterior, medial/lateral, superior/inferior, proximal/distal

Structure and Functions:

- **Cell and Its Organelles** – Plasma membrane, nucleus, mitochondria, Golgi apparatus, lysosomes, endoplasmic reticulum (smooth and rough), ribosomes, centrioles
- **Basic Tissues:**
    - **Epithelial tissue** – Types (simple squamous, cuboidal, columnar; stratified), functions and locations
    - **Connective tissue** – Areolar, adipose, cartilage (hyaline, elastic, fibrocartilage), bone, blood

- **Muscular tissue** – Skeletal, cardiac, and smooth muscle: location, microscopic features, functions
- **Nervous tissue** – Neurons and neuroglia; structure and function

UNIT 2

Embryology and Development:

Gametogenesis and Fertilization:

- Spermatogenesis and oogenesis
- Structure of sperm and ovum
- Fertilization process, site (ampulla), and formation of zygote

Early Embryonic Development:

- Cleavage and formation of blastomeres
- Morula and blastocyst stages
- Trophoblast and embryoblast differentiation

Germ Layers and Derivatives:

- Formation of trilaminar germ disc: ectoderm, mesoderm, and endoderm
- Contributions of each layer to organs and systems (e.g., ectoderm → skin, eye structures; mesoderm → muscle, bones; endoderm → gut lining)

Basics of Eye Development:

- Formation of optic vesicle and optic cup
- Development of lens placode and lens vesicle
- Differentiation of retina, choroid, sclera
- Development of eyelids and lacrimal apparatus (brief)

UNIT 3

Skeletal and Muscular System:

Classification and Structure of Bones:

- Types of bones: long, short, flat, irregular, sesamoid
- Gross structure: periosteum, compact bone, cancellous bone, marrow cavity
- Microscopic structure: osteons, lamellae, lacunae, canaliculi

Types of Joints:

- **Fibrous joints** – Sutures (e.g., skull), syndesmosis
- **Cartilaginous joints** – Synchondrosis (epiphyseal plates), symphysis (pubic symphysis)
- **Synovial joints** – Hinge (elbow), ball & socket (shoulder), pivot (atlanto-axial), saddle (thumb), plane (intercarpal), condyloid (knee)

Muscles of Head, Neck, Face, and Orbit:

- Major muscles of mastication (masseter, temporalis)
- Facial muscles (orbicularis oculi, orbicularis oris)
- Neck muscles (sternocleidomastoid, trapezius)
- Orbital muscles (levator palpebrae superioris, orbicularis oculi)

Extraocular Muscles:

- Names: superior rectus, inferior rectus, medial rectus, lateral rectus, superior oblique, inferior oblique
- Origin, insertion, action, and nerve supply
- Role in eye movement (adduction, abduction, elevation, depression, intorsion, extorsion)

Bone Ossification and Growth:

- Intramembranous and endochondral ossification
- Primary and secondary ossification centers
- Growth plate (epiphyseal plate)
- Factors affecting bone growth (nutrition, hormones)

UNIT 4

Circulatory and Lymphatic System:

Anatomy of the Heart and Major Blood Vessels:

- External and internal features of the heart
- Chambers, valves, septa, conduction system (SA node, AV node)
- Aorta, pulmonary arteries and veins, superior and inferior vena cava

Arterial Supply of Head and Neck:

- Common carotid artery → internal and external carotid
- Ophthalmic artery: origin, course, and branches supplying the eye and orbit

Venous Drainage:

- Superficial and deep veins of head and face
- Cavernous sinus: location, tributaries, and clinical relevance (e.g., thrombosis)

Lymphatic Drainage of Face and Neck:

- Lymph nodes: preauricular, submandibular, submental, cervical
- Pathways of drainage from eye, face, and scalp

Structure and Function of Blood Components:

- RBCs: structure, function, lifespan
- WBCs: types (neutrophils, lymphocytes, monocytes, eosinophils, basophils) and functions
- Platelets: function in clotting
- Plasma: composition and role in transport, immunity

UNIT 5

Digestive System and Accessory Organs:

Digestive Tract Anatomy:

- Oral cavity, pharynx, esophagus
- Stomach: regions, curvatures, sphincters
- Small intestine: duodenum, jejunum, ileum
- Large intestine: cecum, colon, rectum, anal canal

Salivary Glands, Tongue, Pharynx, and Esophagus:

- Major salivary glands: parotid, submandibular, sublingual – location, ducts
- Tongue: muscles and taste areas
- Pharynx: nasopharynx, oropharynx, laryngopharynx
- Esophagus: course and relations

Liver:

- Gross anatomy: lobes, surfaces, porta hepatis
- Histology (hepatocytes, sinusoids)
- Functions: metabolism, bile production, detoxification

Gall Bladder and Bile Ducts:

- Location and function of gall bladder
- Biliary tract: hepatic ducts, cystic duct, common bile duct
- Role in bile storage and release

Pancreas:

- Location: retroperitoneal
- Parts: head, body, tail
- Exocrine function: digestive enzyme secretion
- Relation to duodenum

Spleen:

- Location, structure, and peritoneal relations
- White pulp vs red pulp
- Function in immunity and blood filtration

Practical

- Identification of bones of skull and orbit
- Surface anatomy and palpation of key arteries
- Histology slides: epithelial tissues, muscle tissue, connective tissues
- Models: digestive system, circulatory system
- Introduction to anatomical imaging: X-rays, CT/MRI of head & neck

Reference Books:

1. B.D. Chaurasia – Human Anatomy Vol. 1, 2, 3 (CBS Publishers).
2. Inderbir Singh – Textbook of Human Histology (Jaypee Brothers).
3. Gray's Anatomy for Students – Richard Drake et al.
4. Snell's Clinical Anatomy by Regions – Richard S. Snell.
5. Ross & Wilson – Anatomy and Physiology in Health and Illness – Waugh & Grant.

UNIT 1

Ocular Anatomy – I

1. **Embryology of the Eye and Related Anomalies**
    - Development of the eyeball: optic vesicle, optic cup, and lens vesicle
    - Embryological origin of cornea, retina, iris, sclera, choroid
    - Common congenital anomalies: coloboma, anophthalmia, microphthalmia, congenital cataract, persistent pupillary membrane
2. **Orbit**
    - Bones forming the orbit: frontal, sphenoid, ethmoid, lacrimal, maxilla, palatine, zygomatic
    - Boundaries: medial, lateral, superior, inferior walls
    - Openings: optic canal, superior/inferior orbital fissure
    - Contents: eyeball, muscles, nerves, vessels, fat, glands
3. **Eyelids (Lids)**
    - Layers of eyelid
    - Muscles: orbicularis oculi, levator palpebrae superioris, Muller's muscle
    - Glands: Meibomian (tarsal), glands of Zeis, glands of Moll
    - Functions of lids and blink reflex
4. **Conjunctiva**
    - Types: bulbar, palpebral, forniceal
    - Blood supply and venous drainage
    - Nerve supply and lymphatic drainage
    - Clinical relevance: conjunctivitis, injection, chemosis
5. **Cornea**
    - Five layers: epithelium, Bowman's layer, stroma, Descemet's membrane, endothelium
    - Corneal innervation: sensory (via trigeminal nerve)
    - Corneal nutrition: tear film, aqueous humor, limbal vessels
    - Clinical relevance: keratitis, corneal edema
6. **Sclera**
    - Structure and layers: episclera, sclera proper, lamina fusca
    - Vascular supply: anterior/posterior ciliary vessels
    - Clinical relevance: scleritis, episcleritis, staphyloma

UNIT 2

Ocular Anatomy – II

1. **Iris and Ciliary Body**
    - Parts, layers, and muscles of iris
    - Blood supply: long posterior and anterior ciliary arteries
    - Functions: pupillary control, aqueous production, accommodation
2. **Lens**
    - Anatomy: capsule, cortex, nucleus
    - Zonular fibers and suspensory apparatus
    - Transparency and aging changes (e.g., cataract)
3. **Vitreous**
    - Composition: water, collagen, hyaluronic acid
    - Attachments: vitreous base, optic disc, macula, blood vessels
4. **Retina**
    - Ten histological layers
    - Macula: fovea centralis, structure, and function
    - Optic disc: structure, blind spot, clinical importance
5. **Choroid**
    - Layers: Bruch's membrane, choriocapillaris, vessel layer, suprachoroid
    - Vascular supply and role in retinal nourishment
6. **Ocular Muscles**
    - Extraocular muscles: origin, insertion, action
    - Innervation: LR6SO4R3 rule
    - Yoke muscles and eye movements
7. **Visual Pathway**
    - Path: retina → optic nerve → optic chiasm → optic tract → LGN → optic radiations → visual cortex
    - Clinical lesions: anopia, hemianopia, quadrantanopia
8. **Vascular Supply of Eye and Orbit**
    - Arteries: ophthalmic artery and branches
    - Venous drainage: central retinal vein, vortex veins
    - Lymphatic drainage and relevance in infection/inflammation
9. **Lacrimal Apparatus**
    - Lacrimal gland: anatomy, secretion control
    - Drainage system: puncta, canaliculi, lacrimal sac, nasolacrimal duct
10. **Autonomic Control**
    - Sympathetic and parasympathetic innervation
    - Functions: pupil size, accommodation, lacrimal secretion
11. **Higher Visual Centers**
    - Lateral geniculate nucleus (LGN)
    - Primary and secondary visual cortex
    - Visual processing pathways (dorsal and ventral streams)

UNIT 3

Ocular Pathology – Haematology

1. **Introduction to Haematology**
   - Composition of blood, functions, and importance in diagnostics
   - Methods of blood sample collection: capillary, venous, anticoagulants
2. **Hemoglobin Estimation**
   - Techniques: Sahli's method, Cyanmethemoglobin method
   - Normal values and clinical significance (e.g., anemia)
3. **Total and Differential Leucocyte Count**
   - Techniques of counting WBCs
   - Differential count and identification of cell types
   - Clinical relevance: infections, leukemia
4. **Peripheral Blood Film (PBF)**
   - Preparation, staining (Leishman's/Giemsa), and interpretation
   - Morphology of RBCs, WBCs, platelets
   - Diagnostic features of anemia, leukemia
5. **Erythrocyte Sedimentation Rate (ESR)**
   - Methods: Westergren and Wintrobe
   - Normal values and pathological relevance
6. **Bleeding Time and Clotting Time**
   - Methods: Duke's and Ivy for BT, Capillary/Lee-White for CT
   - Interpretation in bleeding disorders
   -

UNIT 4

Ocular Pathology – Clinical Pathology

1. **Urine Collection**
   - Methods: random, midstream, 24-hour
   - Preservation and container types
2. **Physical Examination of Urine**
   - Color, clarity, volume
   - Specific gravity: significance in renal function
3. **Chemical Analysis**
   - pH: acidic/alkaline urine
   - Proteinuria: heat test, reagent strips
   - Glucose: Benedict's test, dipstick
   - Ketones: Rothera's test
4. **Microscopic Examination**
   - Sediment examination: centrifugation, slide prep
   - Identification: pus cells, epithelial cells, RBCs, casts, crystals

UNIT 5

Ocular Microbiology

1. **Introduction to Microbiology**
   - History, scope in ophthalmology
   - Classification: bacteria, viruses, fungi, parasites
2. **Gram-positive Bacteria**
   - Morphology and classification
   - Examples: Staphylococcus, Streptococcus (relevance to conjunctivitis, keratitis)
3. **Gram-negative Bacteria**
   - Morphology and examples: Pseudomonas, Neisseria
   - Role in ocular infections (e.g., corneal ulcers)
4. **Fungi**
   - Saprophytic vs pathogenic fungi
   - Common ocular fungi: Candida, Aspergillus
   - Fungal infections: keratomycosis, endophthalmitis
5. **Staining Techniques**
   - Gram staining: procedure and interpretation
   - KOH mount: fungal elements
   - Ziehl-Neelsen (ZN) staining: acid-fast bacilli (e.g., TB)
6. **Aseptic Techniques**
   - Sample collection: conjunctival swabs, corneal scrapings
   - Transport media and culture precautions
   - Contamination prevention in ophthalmic microbiology

Practical's

- Demonstration of ocular anatomical models and charts
- Blood sample collection and Hb estimation
- TLC, DLC, ESR and BT/CT
- Urine analysis: physical, chemical, microscopic
- Staining techniques: Gram stain, PBF, fungal mounts
- Identification of microorganisms from prepared slides

Reference Books: Khurana A.K. – *Comprehensive Ophthalmology*, CBS Publishers

1. Ghai C.L. – *A Textbook of Practical Physiology*, Jaypee Brothers
2. Kanski J.J. – *Clinical Ophthalmology: A Systematic Approach*, Elsevier
3. Parson's – *Diseases of the Eye*, Butterworth-Heinemann
4. Pelczar M.J. – *Microbiology: Applications and Concepts*, McGraw Hill

COURSE NAME: Ocular Physiology & Including binocular reflexes and its maintenance

COURSE CODE: OT-103

UNIT 1

General Ocular Physiology

1. **Introduction to Ocular Physiology**
   - Definition, scope, and significance in clinical ophthalmology
   - Relevance of physiological processes in visual health and eye diseases
2. **Functional Overview of the Eye**
   - Eye as a specialized sensory organ
   - Transformation of light into neural signals
   - Integration with central nervous system for visual perception
3. **Structure-Function Correlation of Ocular Tissues**
   - Cornea: transparency and curvature
   - Lens: accommodation and clarity
   - Retina: photo transduction
   - Iris: light regulation
   - Extraocular muscles: eye movements
4. **Blood-Ocular Barriers**
   - Aqueous-Blood Barrier:
     - Formed by non-pigmented ciliary epithelium
     - Role in maintaining aqueous humour composition
   - Retinal-Blood Barrier:
     - Inner (retinal capillary endothelial cells)
     - Outer (retinal pigment epithelium)
     - Role in protecting retinal neurons from systemic toxins

UNIT -2

Corneal and Lens Transparency

1. **Physiology of Corneal Transparency**
   - Role of collagen fibril spacing and stromal dehydration
   - Importance of regular arrangement and lack of blood vessels
   - Role of epithelium and endothelium
2. **Endothelial Pump Function**
   - Sodium-potassium ATPase mechanism
   - Maintenance of stromal hydration (deturgescence)

- Impact of endothelial dysfunction

3. **Lens Transparency**
   - Role of crystallins: structure and refractive index
   - Lens capsule and selective permeability
   - Avascular nutrition via aqueous and vitreous
   - Factors maintaining transparency: protein stability, antioxidative systems
4. **Age-related Changes**
   - Lens sclerosis and presbyopia
   - Development of opacities: cataract formation basics

UNIT- 3

Visual Functions and Reflexes

- **Visual Acuity**
  - Definition and types: distance, near, dynamic
  - Influencing factors: lighting, contrast, refractive error
  - Measurement techniques (Snellen, Log MAR, pinhole)
- **Form Sense and Contrast Sensitivity**
  - Form sense: ability to distinguish shape and size
  - Contrast sensitivity: role in night vision and low-light performance
- **Pupillary Reflexes**
  - **Light Reflex**:
    - Direct and consensual response
    - Pathway: retina → optic nerve → pretectal nucleus → Edinger-Westphal nucleus → oculomotor nerve → sphincter 20 apillar
  - **Near Reflex (Accommodation Reflex)**:
    - Triad: accommodation, convergence, 20 apillary constriction
    - Neural pathways and control centers
  - **Clinical Relevance**:
    - Argyll Robertson pupil, Marcus Gunn pupil, afferent/efferent defects
- **Convergence Mechanism**
  - Role of medial rectus muscles and oculomotor nerve
  - Neural control from supra-ocular motor area
  - Binocular coordination and fusion

UNIT-4

Intraocular Pressure (IOP)

1. **Aqueous Humor Physiology**
   - Formation by ciliary body (active secretion, ultrafiltration)
   - Circulation: posterior chamber → pupil → anterior chamber
   - Drainage: trabecular meshwork → Schlemm's canal → episcleral veins
   - Alternate pathway: uveoscleral outflow
2. **Normal IOP Values**
   - Normal range: 10–21 mmHg
   - Diurnal variations
3. **Measurement Techniques**
   - Applanation tonometry (Goldmann)
   - Non-contact (air puff)
   - Schiotz tonometry
   - Rebound tonometry
4. **Factors Influencing IOP**
   - Age, posture, time of day
   - Medication, aqueous production/outflow dynamics
5. **Glaucoma – Basic Pathophysiology**
   - Raised IOP as a risk factor
   - Optic nerve head changes
   - Visual field defects
   - Overview of open-angle and angle-closure glaucoma

UNIT-5

Ocular Biochemistry

1. **Tear Film Layers**
   - **Three layers**:
     - Lipid layer (meibomian glands): prevents evaporation
     - Aqueous layer (lacrimal gland): nutrients and antimicrobial agents
     - Mucin layer (goblet cells): adherence to ocular surface
   - Composition: electrolytes, proteins (lysozyme, lactoferrin), immunoglobulins
   - Normal pH: 6.5–7.6
   - Daily secretion volume and reflex tearing
2. **Role of Tear Film in Ocular Health**
   - Lubrication, oxygenation of cornea
   - Antibacterial defense
   - Debris removal and wound healing

3. **Basic Biochemical Processes in Ocular Tissues**
    - **Carbohydrate Metabolism**:
        - Glycolysis, pentose phosphate pathway (especially in lens)
        - Sorbitol pathway and diabetic cataract formation
    - **Lipid Metabolism**:
        - Lipid components in tear film
        - Role in retinal photoreceptors (retinal fatty acids)
    - **Protein Metabolism**:
        - Crystallins in lens, enzyme proteins
        - Protein denaturation and cataract
4. **Enzymes and Antioxidants**
    - Key enzymes: aldose reductase, catalase, superoxide dismutase (SOD)
    - Role in oxidative stress prevention
    - Antioxidants: Vitamin C, glutathione, lutein, zeaxanthin
5. **Free Radicals and Oxidative Damage**
    - Sources of free radicals in the eye (UV, metabolic stress)
    - Effects: lens opacification, retinal degeneration
    - Protective mechanisms and clinical relevance in aging and ocular diseases

Reference Books:

1. Khurana A.K. – Comprehensive Ophthalmology, Jaypee Brothers.
2. Ahuja R.B. – Textbook of Ocular Physiology, CBS Publishers.
3. Adler's Physiology of the Eye – Leonard A. Levin et al., Elsevier.
4. Kanski's Clinical Ophthalmology – Brad Bowling, Elsevier.
5. Basic and Clinical Science Course (BCSC) – American Academy of Ophthalmology.

COURSE NAME: OPTICS-1

COURSE CODE: OT-104

UNIT 1

Fundamentals of Light and Physical Optics

1. **Nature and Properties of Light**
   - Dual nature of light: wave and particle theories
   - Basic properties: speed, wavelength, frequency, reflection, and refraction
   - Phenomena of light:
     - **Interference** – principle, examples (Newton's rings)
     - **Diffraction** – single slit, edge diffraction
     - **Polarization** – definition, methods (reflection, filters)
     - **Spectrum** – visible spectrum, dispersion by prism
2. **Basic Fluid Properties in Optics (Overview)**
   - **Surface tension**: relevance to tear film stability
   - **Viscosity**: relation to intraocular fluids and contact lens solutions
3. **Refraction Principles**
   - Snell's Law and derivation
   - Refractive index: absolute and relative
   - Refractive media in the eye: cornea, aqueous, lens, vitreous

UNIT 2

Geometrical Optics – Lenses and Surfaces

1. **Types of Lenses**
   - Convex (converging) and Concave (diverging)
   - Plano-convex, plano-concave, meniscus lenses
   - Uses in vision correction
2. **Lens Formulas**
   - Thin lens formula ($1/f = 1/v - 1/u$)
   - Lens maker's formula
   - Thick lens considerations: principal planes, front and back vertex power
3. **Types of Optical Surfaces**
   - **Spherical** – single radius curvature
   - **Cylindrical** – correcting astigmatism
   - **Toric surfaces** – combination of sphere and cylinder
   - **Aspheric surfaces** – reduced aberrations and improved peripheral clarity

UNIT 3

Optical Systems and Visual Corrections

1. **Aberrations in Lenses**
   - **Spherical aberration** – rays failing to converge at a single point
   - **Chromatic aberration** – dispersion of colours due to wavelength variation
2. **Astigmatism and Strum's Conoid**
   - Concept of focal lines and circle of least confusion
   - Astigmatic foci and impact on vision clarity
3. **Lens Transposition**
   - **Simple transposition**: plus/minus cylinder form interchange
   - **Toric transposition**: toric lens power adjustment for prescription
4. **Prisms in Optics**
   - Definition and parts: apex, base
   - UNITs of prism: prism 24apilla
   - Clinical uses: binocular vision problems, diplopia management
   - Identification and base direction

UNIT 4

Spectacle Lens Power and Fitting

1. **Determining Lens Power**
   - Dioptric system: 1/f (in meters)
   - Focal length calculation for convex/concave lenses
2. **Neutralization of Lenses**
   - Manual and focimeter-based methods to identify unknown lenses
3. **Focimeter/ Lensometer Use**
   - Determination of:
     - Spherical and cylindrical power
     - Axis and optical centre
     - Prism verification
   - Marking centre and axis for spectacles
4. **Prismatic Effects and Decentration**
   - Prentice's Rule ($P = c \times F$)
   - Induced prism due to incorrect alignment
   - Methods to reduce unwanted prismatic effect
5. **Spectacle Lens Enhancements**
   - Tints: cosmetic vs therapeutic
   - Coatings: anti-reflective, scratch-resistant, UV protection
   - Aberrations and patient adaptation issues

UNIT 5

Clinical Ocular Optics and Refraction

1. **Anatomical Eye Models**
    - **Schematic eye** – standard model for optics study
    - **Reduced eye** – simplified optical model
2. **Refractive States of the Eye**
    - **Emmetropia**: normal vision
    - **Ametropia**: refractive errors
        - **Myopia** – elongated eyeball, corrected with concave lenses
        - **Hypermetropia** – short eyeball, corrected with convex lenses
        - **Astigmatism** – unequal curvature, corrected with cylindrical lenses
3. **Presbyopia**
    - Age-related reduction in accommodation
    - Onset, signs, and optical correction methods (bifocals, progressives)
4. **Special Conditions**
    - **Aphakia** – absence of natural lens; corrected with high plus lenses or IOLs
    - **Pseudophakia** – presence of artificial IOLs
    - **Irregular reflexes** – diagnostic significance
    - **Post-operative refractive errors** – causes and correction strategies
5. **Accommodation and Convergence**
    - **Accommodation**:
        - Definition, mechanism (lens elasticity, ciliary muscle)
        - Far point, near point, amplitude, range
        - Clinical testing methods
    - **Convergence**:
        - Mechanism and neural control
        - Near point of convergence (NPC)
        - Clinical relevance of convergence insufficiency/excess

Practicals

- Demonstration of 25apillary reflexes.
- Visual acuity testing using Snellen's chart.
- IOP measurement using tonometer (demo).
- Observation of tear breakup time (TBUT) and Schirmer's test.
- Models/charts of aqueous circulation and corneal/lens structures.

Reference Books

1. Khurana A.K. – *Theory and Practice of Optics and Refraction*, Elsevier
2. Ghatak Ajoy – *Optics*, Tata McGraw Hill
3. Borish I.M. – *Clinical Refraction*, Butterworth-Heinemann
4. Bennett & Rabbetts – *Clinical Visual Optics*, Elsevier

SEMSETER-II

COURSE NAME: HUMAN ANATOMY & PHYSIOLOGY-2
COURSE CODE: OT-201

UNIT 1

Respiratory System

1. **Structure of the Respiratory Tract**
   - **Upper respiratory tract**: nose (nostrils, nasal cavity), pharynx (nasopharynx, oropharynx, laryngopharynx)
   - **Lower respiratory tract**: larynx (vocal cords), trachea, bronchi, bronchioles
   - **Lungs**: lobes, pleura, bronchopulmonary segments
2. **Alveoli and Gas Exchange**
   - Alveolar structure: Type I and Type II pneumocytes
   - Gas exchange across respiratory membrane: diffusion of O_2 and CO_2
   - Partial pressure gradients and surface area factors
3. **Mechanism of Breathing**
   - Inspiration and expiration (quiet and forced)
   - Role of diaphragm, intercostal muscles
   - Pressure changes in thoracic cavity
   - Lung compliance and elasticity
4. **Lung Volumes and Capacities**
   - Definitions and normal values:
     - Tidal volume (TV), Inspiratory reserve volume (IRV), Expiratory reserve volume (ERV), Residual volume (RV)
     - Vital capacity (VC), Functional residual capacity (FRC), Total lung capacity (TLC)
5. **Transport of Gases**
   - Oxygen transport: bound to haemoglobin (Oxyhaemoglobin)
   - Carbon dioxide transport: bicarbonate ion (70%), carbaminohaemoglobin, dissolved in plasma
   - Oxygen-haemoglobin dissociation curve
6. **Regulation of Respiration**
   - Respiratory centres in medulla and pons
   - Chemoreceptors: central and peripheral
   - Role of CO_2 and O_2 levels in respiratory drive
7. **Common Respiratory Conditions** *(Brief Overview)*
   - **Asthma**: bronchial hyperreactivity and inflammation
   - **Bronchitis**: inflammation of bronchial tubes
   - **Emphysema**: alveolar damage and air trapping

UNIT 2

Endocrine System

1. **Introduction**
   - Difference between endocrine and exocrine glands
   - Functions of the endocrine system: metabolism, growth, reproduction
2. **Pituitary Gland (Hypophysis)**
   - **Anterior lobe hormones**: GH, TSH, ACTH, FSH, LH, Prolactin – functions and control
   - **Posterior lobe hormones**: ADH, Oxytocin – site of production and actions
3. **Thyroid and Parathyroid Glands**
   - **Thyroid hormones**: T3, T4 – synthesis, functions in metabolism
   - **Parathyroid hormone (PTH)**: calcium regulation
   - Role of calcitonin
4. **Adrenal Glands**
   - **Cortex**:
     - Mineralocorticoids (aldosterone)
     - Glucocorticoids (cortisol)
     - Androgens
   - **Medulla**:
     - Adrenaline, noradrenaline – fight-or-flight response
5. **Pancreas**
   - **Endocrine function**:
     - Insulin: glucose uptake and storage
     - Glucagon: glycogen breakdown
   - Role in glucose homeostasis
6. **Feedback Mechanisms**
   - **Negative feedback**: control of hormone levels (e.g., thyroid hormones)
   - **Positive feedback**: oxytocin in labour
7. **Common Endocrine Disorders**
   - **Diabetes mellitus**: insulin deficiency or resistance
   - **Hyperthyroidism**: excessive thyroid hormone
   - **Hypothyroidism**: deficient thyroid hormone

UNIT 3

Excretory and Reproductive System

A. Excretory System

1. **Structure and Function**
   - Organs: kidneys, ureters, urinary bladder, urethra
   - Functions: waste excretion, fluid balance, pH regulation

2. **Nephron – Functional UNIT**
    - Parts: glomerulus, Bowman's capsule, proximal and distal tubules, loop of Henle, collecting duct
    - Juxtaglomerular apparatus and renin secretion
3. **Urine Formation**
    - **Filtration**: in glomerulus
    - **Reabsorption**: PCT, loop of Henle
    - **Secretion**: active removal of waste into tubule
    - Final urine concentration and composition
4. **Fluid and Electrolyte Balance**
    - Role of aldosterone, ADH in water/salt regulation
    - Sodium, potassium, calcium balance

B. Reproductive System

1. **Male Reproductive Organs**
    - Structure and function of testis, vas deferens, seminal vesicles, prostate, penis
    - Spermatogenesis and hormonal control (testosterone, FSH, LH)
2. **Female Reproductive Organs**
    - Structure of ovary, uterus, fallopian tubes, vagina
    - Oogenesis and female sex hormones (estrogen, progesterone)
3. **Menstrual Cycle**
    - Phases: menstrual, proliferative, secretory
    - Hormonal regulation: FSH, LH, strogen, progesterone
4. **Fertilization and Conception** *(Brief Overview)*
    - Sperm-egg interaction
    - Zygote formation and implantation basics

UNIT 4

Nervous System

1. **Overview**
    - Divisions:
        - **Central nervous system (CNS)**: brain and spinal cord
        - **Peripheral nervous system (PNS)**: nerves
        - **Autonomic nervous system (ANS)**: sympathetic and parasympathetic

2. **Central Nervous System**
    - **Brain**:
        - **Cerebrum**: lobes and higher functions

        - **Cerebellum**: coordination and balance
        - **Brainstem**: midbrain, pons, medulla – life-support functions
    - Meninges and cerebrospinal fluid (brief)
3. **Cranial Nerves**
    - List of 12 cranial nerves
    - Origin (brainstem), course, distribution, and primary functions
4. **Spinal Cord**
    - External and internal structure
    - Segmental arrangement and spinal nerves
5. **Reflex Arc**
    - Components: receptor, sensory neuron, integration centre, motor neuron, effector
    - Types: monosynaptic, polysynaptic
6. **Autonomic Nervous System**
    - **Sympathetic system**: fight-or-flight functions
    - **Parasympathetic system**: rest-and-digest
    - Neurotransmitters: acetylcholine, norepinephrine
    - Receptors and physiological effects

UNIT 5

Nutrition and Sensory Organs

A. Nutrition

Food and Health

    - Role of balanced diet in maintaining physiological function
2. **Macronutrients**
    - **Carbohydrates**: sources, energy role
    - **Proteins**: structure, functions, sources
    - **Fats**: types (saturated/unsaturated), role in energy and hormones
3. **Micronutrients**
    - **Vitamins**:
        - Fat-soluble (A, D, E, K): sources, functions
        - Water-soluble (B-complex, C): sources, deficiency disorders
    - Minerals: calcium, iron, iodine – roles and deficiency effects
4. **Protein Metabolism**
    - Digestion and absorption
    - Amino acid utilization
    - Significance in growth, repair, enzyme synthesis

B. Special Senses

1. **Taste (Gustation)**
    - Taste buds: structure and location (tongue, soft palate)
    - Primary tastes: sweet, salty, sour, bitter, umami
    - Nerve supply: facial (VII), glossopharyngeal (IX), vagus (X)
2. **Smell (Olfaction)**
    - Olfactory epithelium in nasal cavity
    - Receptor neurons and regeneration
    - Olfactory nerve (I) pathway to olfactory bulb and brain

Practical's

1.Measurement of Respiratory Rate and Breath Holding Time
2. Urine Analysis (Physical and Chemical Tests)
3. Testing of Reflexes
4. Identification of Endocrine Glands (Charts/Models)
5. Taste Sensation Testing
6. Body Mass Index (BMI) Calculation

Reference Books:

1. A.K. Jain – *Textbook of Physiology* (Vol I & II)
2. B.D. Chaurasia – *Human Anatomy* (Vol 3 – Head, Neck & Brain)
3. Sembulingam & Sembulingam – *Essentials of Medical Physiology*
4. Guyton & Hall – *Textbook of Medical Physiology*
5. Tortora & Derrickson – *Principles of Anatomy and Physiology*

UNIT 1

Ocular Muscles and Visual Pathways

1. **Extraocular Muscles**
   - **Types**: Four recti (superior, inferior, medial, lateral) and two obliques (superior, inferior)
   - **Actions**:
     - Movements in primary, secondary, and tertiary positions
     - Synergistic and antagonistic muscle pairs
2. **Cranial Nerve Innervation**
   - **Oculomotor nerve (CN III)**: supplies superior, inferior, medial rectus, inferior oblique, and levator palpebrae superioris
   - **Trochlear nerve (CN IV)**: supplies superior oblique
   - **Abducent nerve (CN VI)**: supplies lateral rectus
3. **Clinical Correlation**
   - Applied anatomy in:
     - **Squint (Strabismus)**: paralytic vs. non-paralytic
     - **Nerve palsies**: signs, diplopia, compensatory head posture
4. **Visual Pathway**
   - Complete pathway:
     - Retina → Optic nerve → Optic chiasma → Optic tract → Lateral Geniculate Body (LGB) → Optic radiations → Visual cortex (Occipital lobe)
   - Crossings at chiasma and role of nasal/temporal fibers
5. **Pupillary Light Reflex**
   - Pathways: afferent and efferent arms
   - Direct and consensual response
   - Lesions and their effect on reflex
6. **Visual Field Defects**
   - Types: scotoma, hemianopia (bitemporal, homonymous)
   - Lesion-location correlation in visual pathway

UNIT 2

Autonomic Nervous Supply and Vascularization

1. **Sympathetic Innervation of Eye**
   - Origin and pathway (hypothalamus → cervical sympathetic chain → dilator pupillae)
   - Functions: pupil dilation, eyelid elevation (Müller's muscle), vasoconstriction

2. **Parasympathetic Innervation**
    - Origin: Edinger-Westphal nucleus → ciliary ganglion → short ciliary nerves
    - Functions: pupil constriction, accommodation
3. **Clinical Correlation**
    - **Horner's Syndrome**: features – ptosis, miosis, anhidrosis
    - **Adie's Pupil**: tonic pupil with poor reaction to light but near reflex present
4. **Arterial Supply**
    - **Ophthalmic artery** (branch of internal carotid)
    - Branches:
        - Central retinal artery
        - Short and long posterior ciliary arteries
        - Lacrimal, supraorbital, ethmoidal branches
5. **Venous Drainage**
    - **Central retinal vein**, **vortex veins**
    - Drainage into cavernous sinus and pterygoid plexus
6. **Clinical Relevance**
    - **Glaucoma**: relation to blood supply and IOP
    - **CRVO (Central Retinal Vein Occlusion)** and ischemic effects

UNIT 3

Lacrimal Apparatus and Higher Visual Centres

1. **Lacrimal Gland**
    - Location: orbital part and palpebral part
    - Secretory function: reflex and basal tearing
    - Neural control: parasympathetic via facial nerve
2. **Drainage Pathway**
    - Puncta → Canaliculi → Lacrimal sac → Nasolacrimal duct → Inferior meatus of nose
    - Valves of Hasner and Rosenmuller
3. **Clinical Conditions**
    - **Dry Eye**: causes, tear film instability
    - **Dacryocystitis**: inflammation of lacrimal sac
4. **Higher Visual Centres**
    - Visual cortex: Area 17 (primary visual cortex), Area 18 (visual association)
    - Functional role in visual perception, processing of form, colour, motion
5. **Associated Conditions**
    - **Cortical Blindness**: normal eye but damaged occipital cortex
    - **Visual Hallucinations**: from cortical irritation or lesion

UNIT 4

Ocular Histopathology

1. **Tissue Fixation and Processing**
    - Purpose of fixation
    - Common fixatives: formalin
    - Dehydration, clearing, embedding (paraffin)

2. **Section Cutting Techniques**
    - Use of microtome
    - Preparation of tissue slides
3. **Common Stains**
    - **Hematoxylin & Eosin (H&E)**: general staining
    - **Periodic Acid-Schiff (PAS)**: basement membranes, mucopolysaccharides
    - **Gram stain**: basic bacterial identification
4. **Microscopic Study of Eye Tissues**
    - Conjunctiva: epithelial layers, goblet cells
    - Cornea: 5 layers under microscope
    - Retina: 10 layers, optic nerve head
5. **Grossing Techniques**
    - Handling of enucleated specimens Orientation, sectioning, and documentation.

UNIT 5

Ocular Microbiology

1. **Viruses Affecting the Eye**
    - **Herpes Simplex Virus (HSV)**: dendritic keratitis
    - **Adenovirus**: epidemic keratoconjunctivitis (EKC)
2. **Chlamydia Trachomatis**
    - Inclusion conjunctivitis
    - Trachoma: WHO grading, ocular manifestations
3. **Parasitic Infections**
    - **Toxoplasmosis**: chorioretinitis
    - **Acanthamoeba Keratitis**: associated with contact lens users
4. **Aseptic Techniques**
    - Proper methods for collecting ocular samples (conjunctival swab, corneal scraping)
    - Avoiding contamination during handling
5. **Sterilization and Disinfection in Eye Care**
    - Methods: autoclaving, ethylene oxide, UV light Importance in clinics, operation theaters, contact lens labs.
    -

Practical's

- Identification of ocular muscles using charts/models.
- Diagrammatic representation of visual pathways.
- Demonstration of lacrimal drainage system on model.
- Preparation and staining of slides using Haematoxylin & Eosin.
- Observation of stained slides: conjunctiva, cornea, retina (demo).
- Demonstration of aseptic technique in sample handling.
- Spot identification: Chlamydia inclusion bodies, Acanthamoeba (photomicrograph/demo)

Reference Books

1. Khurana A.K. – Comprehensive Ophthalmology, CBS Publishers
2. Ramachandran S. – A Manual of Practical Microbiology
3. Kanski's Clinical Ophthalmology – Jack Kanski
4. Ryan's Retina – Stephen J. Ryan
5. Mims' Medical Microbiology – Richard Goering et al.

COURSE NAME: Ocular Physiology & Including binocular reflexes and its maintenance - 2

COURSE CODE: OT-203

UNIT 1

Visual Physiology

1. **Night Vision (Scotopic Vision)**
   - Role of **rods** in dim light conditions
   - Characteristics: high sensitivity, low acuity, no color detection
   - **Dark adaptation**: mechanisms, stages, clinical relevance
   - Vitamin A role in night vision and related deficiency disorders

2. **Daylight Vision (Photopic Vision)**
   - Role of **cones** in bright light conditions
   - Characteristics: low sensitivity, high acuity, color perception
   - **Light adaptation**: rapid response and neural adaptation
3. **Visual Cycle (Photochemical Basis of Vision)**
   - Phototransduction process in rods and cones
   - Rhodopsin and iodopsin – bleaching and regeneration
   - Retinal isomerization (11-cis-retinal to all-trans-retinal)
   - Role of pigment epithelium and vitamin A

UNIT 2

Color Vision and Visual Fields

1. **Theories of Color Vision**
   - **Trichromatic theory (Young-Helmholtz)** – 3 cone types (RGB)
   - **Opponent Process Theory (Hering's theory)** – Red-Green, Blue-Yellow, Black-White
2. **Color Blindness**
   - Congenital vs acquired types
   - Types: protanopia, deuteranopia, tritanopia
   - Clinical color vision tests:
     - Ishihara plates (screening)
     - Farnsworth D-15
     - Nagel anomaloscope (quantitative assessment)
3. **Visual Field Physiology**
   - Central and peripheral field organization

- Binocular field and monocular zones
- Retinal correspondence and field projection

4. **Perimetry and Visual Field Defects**
   - Types of perimetry: kinetic (Goldmann), static (Humphrey)
   - Field defects:
     - **Scotoma**: central, paracentral, blind spot enlargement
     - **Hemianopia**: bitemporal, homonymous
     - Quadrantanopia

UNIT 3

Ocular Motility and Reflexes

1. **Extrinsic Muscles of the Eye**
   - Actions of the 6 extraocular muscles
   - Innervation: CN III, IV, VI
   - Synergistic and antagonistic muscle relationships
2. **Types of Eye Movements**
   - **Voluntary movements**: saccades, smooth pursuits
   - **Involuntary movements**: nystagmus
   - **Reflex movements**: vestibulo-ocular reflex, optokinetic reflex
3. **Conjugate and Disjugate Movements**
   - Conjugate: both eyes move in the same direction
   - Disjugate: opposite direction movement (vergence – convergence/divergence)
4. **Higher Visual Centers and Reflexes**
   - Supranuclear control of eye movements
   - Righting reflexes: vestibular and optical influences
   - Clinical significance in gaze palsies and ocular motor disorders.

UNIT 4

Electrophysiological Assessment

1. **Electroretinography (ERG)**
   - **Components**: a-wave (photoreceptor), b-wave (bipolar/Müller cells), c-wave
   - Types: scotopic, photopic ERG
   - Interpretation in retinal diseases (e.g., retinitis pigmentosa)
2. **Electro-oculography (EOG)**
   - Measures RPE-photoreceptor function
   - Arden ratio and its significance
   - Clinical uses: Best disease, toxic retinopathies
3. **Visual Evoked Potential (VEP)**
   - Measures electrical activity from visual cortex
   - Pattern reversal and flash VEP
   - Clinical application: optic nerve disorders (e.g., optic neuritis, demyelination)

UNIT 5

Ocular Biochemistry

1. **Rhodopsin Cycle and Regeneration**
   - Synthesis of rhodopsin from opsin + 11-cis retinal
   - Bleaching and regeneration cycle
   - Enzymes involved and role of vitamin A
2. **Biochemistry of Aqueous and Vitreous Humour**
   - Composition and formation of aqueous humour
   - Aqueous outflow pathways: trabecular meshwork, Schlemm's canal
   - Vitreous composition: hyaluronic acid, collagen
3. **Lens Metabolism**
   - Glucose utilization pathways:
     - Anaerobic glycolysis
     - Sorbitol (polyol) pathway – relation to diabetic cataract
   - Role of glutathione and antioxidants
4. **Corneal Metabolism and Transparency**
   - Oxygen supply and nutrient diffusion
   - Endothelial pump and Na^+/K^+-ATPase
   - Lactic acid removal and corneal hydration control

Practical's

- Demonstration of visual field testing (confrontation, perimetry)
- Simulation/observation of ERG and VEP
- Color vision testing using Ishihara plates
- Basic tests of ocular motility

Reference Books

1. Khurana A.K. – Physiology of Eye and Ocular Structures
2. Dhingra & Dhingra – Ophthalmology Simplified
3. Adler's – Physiology of the Eye
4. Kanski J.J. – Clinical Ophthalmology
5. Levine & Burns – Ocular Anatomy and Physiology

COURSE NAME: OPTICS-2
COURSE CODE: OT-204

UNIT 1

Visual Optics – Accommodation and Convergence

- **Accommodation**
  – Definition, mechanism of accommodation
  – Amplitude of accommodation and its age-related changes
  – Anomalies: Insufficiency, excess, paralysis
- **Near Point of Accommodation (NPA)**
  – Method of measurement
  – Clinical importance
- **AC/A Ratio (Accommodative Convergence/Accommodation Ratio)**
  – Methods of assessment: heterophoria method, gradient method
  – Interpretation of normal and abnormal values
- **Convergence**
  – Types: Tonic, accommodative, fusional, proximal
  – Measurement: NPC (Near Point of Convergence), prism bar method
  – Convergence anomalies and their clinical management

UNIT 2

Refraction – Theory and Techniques

- **Objective Refraction**
  – Retinoscopy: principles, plane vs concave mirror technique
  – Neutralization method, working distance, common errors
  – Autorefractometry: principle, advantages and limitations
- **Subjective Refraction**
  – Duochrome test, fogging technique, binocular balancing
  – Cross-cylinder technique (Jackson cross-cylinder): principle and use
  – Final prescription refinement for sphere and cylinder
- **Clinical Application**
  – Practical sequence of refraction
  – Recording and interpreting findings

UNIT 3

Ophthalmic Lenses – Types, Designs & Characteristics

- **Lens Materials**
  – Glass, CR-39, polycarbonate: physical properties, pros & cons
  – Plastic lenses: manufacturing processes, characteristics
- **Special Lens Types**
  – High index lenses: definition, benefits for high prescriptions
  – Aspheric lenses: concept, visual and cosmetic benefits
  – Photochromic lenses: principle (silver halide), use in UV protection
  – Tinted and Polaroid lenses: mechanisms and indications
- **Lens Designs**
  – Single vision, bifocals (round-top, flat-top), progressive addition lenses (PAL)
  – Differences between lens designs based on function and patient need

UNIT 4

Spectacle Fitting and Adjustment

- **Measurement for Spectacle Fitting**
  – IPD (Inter-Pupillary Distance): near and distance measurement
  – Optical center marking and centration
  – Vertex distance (VD) and its role in high prescriptions
- **Fitting Techniques**
  – Fitting of bifocal and progressive lenses
  – Prism lens fitting considerations
  – Fitting lenses in frames: types of frames, tools and techniques
- **Edging & Glazing**
  – Equipment used, bevel types, lens edge finishing
  – Importance of accurate alignment
- **Final Checking & Adjustments**
  – Lensometry use for prescription verification
  – Common errors in fitting and how to correct them

UNIT 5

Spectacle Dispensing, Repair & Optometric Environment

- **Handling Patient Complaints**
  – Common complaints: blurred vision, distortion, discomfort
  – Troubleshooting and professional communication
- **Spectacle Repair Techniques**
  – Screw and hinge repairs
  – Frame alignment, basic soldering techniques
- **Special Spectacle Types**
  – Monocell spectacles
  – Ptosis crutches
  – Hemianopic glasses
- **Optometric Instruments**
  – Test charts: types, illumination, placement standards
  – Phoropter: construction, use in refraction
  – Objective optometers and projection charts

Refraction Room Standards

– Ideal room layout, wall color, chair height, lighting standards.
– Ergonomic considerations for patient and practitioner.

Practical's

1. Practice of retinoscopy, objective and subjective refraction, NPA, and AC/A ratio measurements.
2. Handling cross-cylinder technique and use of phoropter, optometer, and projection charts.
3. Lens types and characteristics: aspheric, high-index, photochromatic, tinted, polaroid, bifocal lenses.
4. Spectacle lens manufacturing, glazing, edging, fitting (bifocal/multifocal/prism lenses) and frame adjustments.
5. IPD marking, centration, VD calculation, and standards for refraction room and test charts.
6. Patient complaint handling, prescription verification, and repair of regular and special spectacles.

Reference Books

1. Agarwal R.L. – Textbook of Optics
2. Khurana A.K. – Theory and Practice of Optics and Refraction
3. Grosvenor T.P. – Primary Care Optometry
4. Bennett & Rabbetts – Clinical Visual Optics
5. Borish I.M. – Clinical Refraction

SEMSETER-III

COURSE NAME: Pharmacology & Pharmacy-1

COURSE CODE: OT-301

UNIT 1

Fundamentals of Ocular Pharmacology and Drug Action

- Introduction to pharmacology and its significance in ophthalmology
- Sources of drugs: natural, synthetic, semi-synthetic, and biological
- Classification of ophthalmic drugs
- General principles of drug action
- Mechanism of drug absorption, distribution, metabolism, and excretion
- Drug dosage forms used in ophthalmology

UNIT 2

Autonomic Nervous System and its Ocular Implications

- Anatomy and physiology of sympathetic and parasympathetic innervation in the eye
- Neurotransmitters involved in ocular autonomic control
- Drugs affecting autonomic functions: agonists and antagonists
- Clinical applications of autonomic drugs in ophthalmology
- Definitions, mechanisms of action, and examples of:
    - **Miotics** (e.g., Pilocarpine)
    - **Mydriatics** (e.g., Tropicamide, Phenylephrine)
    - **Cycloplegics** (e.g., Atropine, Cyclopentolate)
    - Indications, contraindications, and side effects

UNIT 3

Routes of Ocular Drug Administration and Bioavailability Local vs. systemic administration

- Topical route: drops, ointments, gels
- Invasive routes: sub conjunctival, retro bulbar, periocular, intraocular
- Advantages and disadvantages of each route
- Factors affecting ocular drug bioavailability
- Strategies to improve ocular drug delivery

UNIT 4

Antimicrobial Therapy in Ocular Infections

A. Antibacterial Drugs:

- Classification: fluoroquinolones, aminoglycosides, macrolides, etc.
- Mechanism of action, resistance patterns
- Indications in blepharitis, conjunctivitis, keratitis, etc.

B. Antifungal Drugs:

- Common ocular fungal pathogens
- Antifungal agents: Natamycin, Amphotericin B, Voriconazole
- Clinical uses and limitations

C. Antiviral Drugs:

- Viral ocular infections: Herpes Simplex, Herpes Zoster
- Antiviral agents: Acyclovir, Ganciclovir, Valacyclovir
- Dosage forms and precautions

UNIT 5

Anti-inflammatory and Anti-glaucoma Drug Therapy

A. Anti-inflammatory Drugs:

- Steroidal drugs: Prednisolone, Dexamethasone
- NSAIDs: Ketorolac, Diclofenac
- Indications, side effects, contraindications

B. Anti-glaucoma Drugs:

- Classification:
  - Beta-blockers (Timolol)
  - Prostaglandin analogues (Latanoprost)
  - Carbonic anhydrase inhibitors (Dorzolamide)
  - Alpha-agonists, miotics
- Mechanisms of action
- Monitoring IOP and adverse effects

Practical's

1. Identification and use of ophthalmic dosage forms like eye drops and ointments.
2. Practice of instilling eye drops and applying ointments correctly.
3. Observation of effects of autonomic drugs like miotics and mydriatics.
4. Demonstration of various ocular drug administration routes (topical, subconjunctival, etc.).
5. Study of antibacterial, antifungal, antiviral, anti-inflammatory, and anti-glaucoma drugs.
6. Understanding drug labelling, safe storage, and disposal methods.

Reference Books

1. Khurana A.K. – Comprehensive Ophthalmology.
2. S. Natarajan – Ocular Pharmacology.
3. Kanski J.J. – Clinical Ophthalmology.
4. Bartlett and Jaanus – Clinical Ocular Pharmacology.
5. Brian T. Gilger – Equine Ophthalmology (for comparative pharmacology references).

UNIT 1

Emmetropia & Ametropia

Definition:

- **Emmetropia**: The optical state where, with accommodation relaxed, parallel rays focus sharply on the retina.
- **Ametropia**: Any refractive condition where images are not focused on the retina, includes **myopia**, **hypermetropia**, and **astigmatism**.
- **Aetiology:**
    - Emmetropia results from balanced relationships between axial length, corneal power, and power during the eye's growth.
- Ametropia may arise from excessive or insufficient axial growth, changes in corneal curvature, or lens anomalies.
- **Population & Distribution:**
- Proportion of emmetropic individuals is lower in older populations due to increased prevalence of refractive errors.
- The relative distribution of each ametropia varies by age, region, urbanization, and ethnicity.
- **Growth of Eye:**
- *Emmetropization*: The coordinated ocular growth during childhood aiming for emmetropia.
- Disruption in this process leads to ametropia, often finalized during adolescence, but susceptible to environmental and genetic factors.

UNIT-2

Myopia (Near-sightedness, Hypermetropia (Farsightedness)

Aetiology:

Primarily due to **axial elongation** of the eyeball, but also caused by increased corneal or lens curvature.
Strong genetic component, but close work, higher education, and less time outdoors contribute.

Population & Distribution:

Prevalence varies: as low as 1.2–4% in young children, but rises to 30–50+% in many adult populations.
Urban, educated, female, and East Asian populations are at higher risk.

Hypermetropia (Farsightedness)

Aetiology:

Usually from a **shorter axial length** or flatter cornea.
Can be hereditary or due to developmental factors.

Population & Distribution:

More prevalent in children, prevalence increases again in advanced age due to lens changes.
Prevalence ranges from ~12–25% depending on population and age

Astigmatism

Aetiology:

Caused by **irregular curvature of cornea or lens**, leading to asymmetric focusing.

May be congenital or acquired; sometimes associated with other refractive errors.

Population & Distribution:

Prevalence ranges 6–38% depending on population and diagnostic criteria.

Tends to increase with age.

Types:

With-the-rule (WTR), Against-the-rule (ATR), Oblique (OBL).

UNIT-3

Aphakia / Pseudophakia, Presbyopia

Aphakia:

Absence of natural lens (usually post-cataract surgery).

Causes high hypermetropia and loss of accommodation.

Pseudophakia:

Presence of artificial intraocular lens (IOL) post-surgery.

Modern IOLs aim for emmetropia, but residual error may remain.

Presbyopia

Aetiology:

Age-related decrease in lens elasticity and accommodative ability, typically apparent after age 40.

Population & Distribution:

Universal with advancing age.

No gender or ethnic predilection.

UNIT-4

Keratoconus, Post-Operative Refractive Errors

Aetiology:

Non-inflammatory, progressive corneal thinning and protrusion.

Etiology involves genetic and environmental factors (e.g., eye rubbing).

Clinical Impact:

Leads to irregular astigmatism and myopia, often causing significant refractive error.

UNIT-5

Post-Operative Refractive Errors

Aetiology:

Residual refractive error post-cataract, refractive, or corneal surgery.

Causes: preoperative calculation error, postoperative IOL shift, corneal changes.

Clinical Management:

May require glasses, contact lenses, or further surgical/laser correction.

Practical's

1. Identification and use of ophthalmic dosage forms like eye drops and ointments.
2. Practice of instilling eye drops and applying ointments correctly.
3. Observation of effects of autonomic drugs like miotics and mydriatics.
4. Demonstration of various ocular drug administration routes (topical, subconjunctival, etc.).
5. Study of antibacterial, antifungal, antiviral, anti-inflammatory, and anti-glaucoma drugs.
6. Understanding drug labelling , safe storage, and disposal methods.

Reference Books

1. Khurana A.K. – Comprehensive Ophthalmology, CBS Publishers
2. Ramachandran S. – A Manual of Practical Microbiology
3. Kanski's Clinical Ophthalmology – Jack Kanski
4. Ryan's Retina – Stephen J. Ryan
5. Mims' Medical Microbiology – Richard Goering et al

COURSE NAME: INVESTIGATIVE OPHTHALMOLOGY-1

COURSE CODE: OT-303

UNIT 1

Orthoptics – General Concept

- **Definition and Scope:**
  Study and clinical management of binocular vision, eye alignment, and eye movement disorders through non-surgical means.
- **Role in Investigation:**
  Orthoptists perform detailed assessments using both clinical and instrumental methods to diagnose and monitor strabismus and binocular vision issues.
- Ocular Muscles and Movements.
- **Anatomy Overview:**
  Function and innervation of extraocular muscles.
- **Evaluation Techniques:**
- Assessment of ocular motility: ductions, versions, and vergences.
- Identification of muscle weakness, restriction, or overaction.

UNIT-2

AC/A Ratio (Accommodative Convergence/Accommodation)

- **Measurement:**
- Calculation methods (gradient, heterophoria technique) to assess convergence response for a given UNIT of accommodation.
- **Clinical Significance:**
  Important in differentiating types of esotropia and planning management.
- **Measurements of Angle of Squint**
- **Clinical Methods:**
- **Cover-Uncover and Alternate Cover Test:** To detect and measure manifest and latent deviation.
- **Prism Bar Measurement:** Quantifies squint in prism diopters.
- **Synoptophore:** Measures and analyzes the angle with high precision.
- **Documentation:**
  Use of abbreviations and recording charts.

UNIT-3

Latent Squint (Phoria)

Detection:

- Use of cover test (latent deviation appears when binocular viewing is interrupted).
- Measurement of phorias and their compensatory mechanisms.

- **Clinical Tests:**
  Maddox rod and Maddox wing tests for heterophoria analysis.

- Maddox Rod
  - **Principle and Use:**
    A dissociating test used to detect and measure heterophoria or latent strabismus.
  - **Procedure:**
    The patient views a point source of light through a cylindrical lens array (the rod), creating a line image, allowing measurement of misalignment.
- Maddox Wing
  - **Principle and Use:**
    A near test for measuring horizontal and vertical phorias (latent squint) at near.
  - **Procedure:**
    Hand-held device with scale readings for assessing deviation with dissociation.

UNIT-4

Synoptophore , Squint Concomitant (Nonparalytic)

- **Principle and Application:**
  An instrument to quantify angle of deviation, assess binocular single vision, and conduct specialized fusion and stereopsis tests.
- **Investigative Use:**
  Differentiates between manifest and latent squint, assesses patient's fusional reserve, and is used in orthoptic exercise regimes.
- **Manifest Concomitant Squint**
- **Investigative Approach:**
- Cover tests at various distances and gazes to confirm constant angle of squint.
- Synoptophore and prism testing to document degree and nature of deviation

UNIT-5

Squint Concomitant (Nonparalytic)

- **Differentiation:**
  Constant (comitant) angle in all directions of gaze; diagnosis involves exclusion of paralytic and restrictive causes through detailed ocular movement examination.
- **Investigative Tools:**
  Prism cover test, synoptophore, binocular vision assessment, stereopsis tests.
- **Paralytic Squint**

- **Clinical Assessment:**
- Detailed motility testing to identify paretic muscle(s) (differences in ductions and versions).
- Hess chart and Lees screen plotting for documenting ocular movement field deficits.
- **Instrumental Investigation:**
- Forced duction test (to rule out mechanical restriction).
- Neurological assessment and possible imaging.

Practical's

Special Investigations (Including Orthoptics)

Investigative Ophthalmology

1. Manifest Squint Work-Up
2. Paralytic Squint Work-Up

Appliances

Ophthalmic Instruments and Appliances

1. Lensometer, Lens Gauge
2. Tonometer
3. Placido Disc
4. Keterometer
5. Vkg
6. Specular Microscopy
7. Exophthalmometer
8. Perimeter

Reference Books

1. Agarwal R.L. – *Textbook of Optics.*
2. Khurana A.K. – *Theory and Practice of Optics and Refraction.*
3. Grosvenor T.P. – *Primary Care Optometry.*
4. Bennett & Rabbetts – *Clinical Visual Optics.*
5. Borish I.M. – *Clinical Refraction.*

COURSE NAME: OPHTHALMIC INSTRUMENTS AND APPLIANCES

COURSE CODE: OT-304

UNIT 1

Indirect Ophthalmoscope, Direct Ophthalmoscope, Slit Lamp: Haag-Streit, Photo-slit Lamp

- **Purpose**: Examination of the fundus (back of the eye) using a bright light and a handheld lens.
- **How it works**: The examiner wears the device on the head, shines light into the patient's eye, and views the retina through a high-powered aspheric lens, offering a wide field of view and stereoscopic (three-dimensional) imaging.
- **Indications**: Useful for detecting retinal detachments and examining the peripheral retina.
- **Slit Lamp: Haag-Streit**
- **Purpose**: Detailed examination of anterior and posterior eye segments using a biomicroscope combined with a focused slit of light.
- **Features**: Provides highly magnified, stereoscopic views of the cornea, iris, lens, and anterior vitreous.
- **Specialty**: Haag-Streit is a renowned brand/model.
- **Photo-slit Lamp**
- **Purpose**: Photography of eye structures during slit lamp examination.
- **How it works**: Attaches a camera to the slit lamp for documentation, teaching, or monitoring disease progression.

UNIT 2

Lens meter / Lens Gauge, Tonometer, Fundus Camera

- **Purpose**: Measurement of the optical power of lenses in spectacles.
- **Function**: Determines sphere, cylinder, axis, and sometimes prism power to verify eyeglass prescriptions.
- **Tonometer**
- **Purpose**: Measures intraocular pressure (IOP).
- **Types**: Includes Goldman applanation tonometer (standard), non-contact ("air-puff"), and others.
- **Significance**: Essential for diagnosing and monitoring glaucoma.

- **Fundus Camera**
  - **Purpose**: Specialized camera system to take color photographs of the retina.
  - **Uses**: Documentation, diagnosis, and monitoring of retinal diseases; often part of screening programs.

UNIT 3

External Eye Photography, Auto-refractometer, Corneal Examination – Placido Disc

- **Purpose**: Captures images of outside structures — eyelids, conjunctiva, sclera, and cornea.
- **Uses**: Baseline records, progression assessment, and patient education.
- **Auto-refractometer**
- **Purpose**: Automatically measures refractive errors in the eye.
- **How it works**: The patient looks into the machine; it estimates myopia, hyperopia, or astigmatism objectively.
- **Corneal Examination – Placido Disc**
- **Purpose**: Evaluates the corneal surface for irregularities.
- **How it works**: A series of concentric rings are reflected on the cornea; distortions indicate surface abnormalities.

UNIT 4:

Corneal Examination – Keratometer, Corneal Examination – V KG

- **Purpose**: Measures corneal curvature.
- **Application**: Assesses corneal astigmatism; essential in contact lens fitting.
- **Corneal Examination – V KG**
- **Note**: Likely refers to a type or method of corneal topography, possibly "Video keratography."
- **Purpose**: Creates a detailed map of the corneal surface curvature.

UNIT 5

Corneal Examination – Specular Microscopy, Corneal Examination – Aesthesiometer

- **Purpose**: Images and counts endothelial cells of the cornea.
- **Significance**: Evaluates corneal health, especially before and after certain surgeries
- **Corneal Examination – Aesthesiometer**
- **Purpose**: Measures corneal sensitivity.
- **Usage**: Assesses nerve function in the cornea, useful in diagnosing conditions like neurotrophic keratopathy.

Practical's

Ophthalmic Instruments And Appliances

1. Lensometer, Lens gauge
2. Tonometer

3. Placido disc
4. Keterometer
5. VKG
6. Specular Microscopy
7. Exophthalmometer
8. Perimeter

Reference Books

1. Khurana A.K. – Comprehensive Ophthalmology, Jaypee Brothers.
2. Ahuja R.B. – Textbook of Ocular Physiology, CBS Publishers.
3. Adler's Physiology of the Eye – Leonard A. Levin et al., Elsevier.
4. Kanski's Clinical Ophthalmology – Brad Bowling, Elsevier.
5. Basic and Clinical Science Course (BCSC) – American Academy of Ophthalmology.

SEMESTER-IV

UNIT-1

Ophthalmic Dyes, Local Anaesthetics

- **Definition:** Chemical agents instilled into the eye to stain certain tissues for improved visualization.
- **Examples:** Fluorescein (for corneal abrasions, tear film assessment), Rose Bengal (dead or damaged cells), Lissamine Green (devitalized cells).

Local Anaesthetics

- **Definition:** Drugs that temporarily numb the eye by blocking nerve signal transmission, used for diagnostic procedures and surgeries.
- **Common Agents:** Proparacaine, Tetracaine, Lidocaine, Bupivacaine.
- **Forms:** Eye drops, gels, ointments, or injections.
- **Uses:** Cataract surgery, corneal procedures, removal of foreign bodies, and other minor eye surgeries.
- **Combinations:** Sometimes combined with hyaluronidase or α2-adrenergic agonists (e.g. clonidine, dexmedetomidine) to improve effect and comfort.

UNIT 2

Ophthalmic Preservatives, Ocular Lubricants

- **Definition:** Chemicals added to multi-dose eye preparations to inhibit microbial growth.
- **Common Types:** Benzalkonium chloride (BAK), Purite, Polyquaternium.
- **Considerations:** Chronic use can sometimes cause ocular surface toxicity, particularly in dry eye or glaucoma patients.

Ocular Lubricants

- **Definition:** Artificial tear preparations used to relieve dryness and irritation.
- **Contents:** Varying compositions—carboxymethylcellulose, hydroxypropyl methylcellulose, polyvinyl alcohol, or hyaluronic acid.
- **Uses:** Dry eye disease, exposure keratopathy, lubrication for contact lens wearers.

UNIT 3

Ocular Irrigating Solutions, Ocular Antiseptics & Disinfectants

- **Definition:** Sterile fluids used to flush the eye or maintain moisture during surgery.
- **Common Solutions:** Balanced Salt Solution (BSS), Ringer's lactate.
- **Purpose:** Prevent corneal dehydration, wash away debris or chemicals.

Ocular Antiseptics & Disinfectants

- **Definition:** Agents used to clean the ocular surface or instruments, reducing infection risk.
- **Examples:** Povidone-iodine for preoperative preparation; hydrogen peroxide and alcohols for instrument disinfection.

UNIT 4

Anti-cataract Agents, Contact Lens Solution

- **Definition:** Drugs aimed at preventing or slowing the progression of cataracts.
- **Current Status:** No widely accepted pharmacological treatment; research ongoing into agents like antioxidant vitamins, aldose reductase inhibitors.
- Contact Lens Solution
- **Purpose:** Clean, disinfect, and store contact lenses.
- **Types:** Multipurpose solutions (cleaning, rinsing, disinfecting), hydrogen peroxide systems, saline solutions.
- **Key Components:** Disinfectants, surfactants, lubricants, sometimes enzymes for protein removal.

UNIT 5

Chelating Agents, Immunosuppressive Agents

- **Definition:** Substances that bind metal ions and remove them from the eye.
- **Example:** EDTA (ethylenediaminetetraacetic acid), used for treating conditions like band keratopathy (calcium deposits).
- Immunosuppressive Agents
- **Definition:** Drugs that reduce immune activity, used in ocular inflammatory diseases.
- **Common Agents:** Cyclosporine (topical for dry eye), corticosteroids (topical/systemic), tacrolimus, mycophenolate mofetil.
- **Uses:** Uveitis, severe allergic conjunctivitis, autoimmune ocular diseases.

Practical's

1. Fluorescein Strip, Rose Bengal Strips preparation
2. Autologous serum eye drops preparation
3. Dilution of drug in different concentration
4. Steroid detection test

Reference Books

1. **Essentials of Medical Pharmacology** – K.D. Tripathi, Jaypee Brothers Medical Publishers, 9th Edition, 2024.
2. **Pharmacology for Nursing Students** – Tara V. Shinde & A.M. Shetty, Elsevier, 2nd Edition, 2022.
3. **Pharmacology and Pharmacotherapeutics** – R.S. Satoskar, S.D. Bhandarkar & S.S. Ainapure, Elsevier, 26th Edition, 2022.
4. **Textbook of Pharmacology** – Rang & Dale, Elsevier, 9th Edition, 2023.
5. **Modern Dispensing Pharmacy** – N.K. Jain, Vallabh Prakashan, 2nd Edition, 2021.
6. **Remington: The Science and Practice of Pharmacy** – David B. Troy & Paul Beringer, Pharmaceutical Press, 23rd Edition, 2021.
7. **Practical Manual of Pharmacology** – C. Kokate & A.P. Purohit, Nirali Prakashan, Latest Edition.
8. **Pharmacognosy and Pharmacology for Allied Health Sciences** – C.K. Narayanan, CBS Publishers, 1st Edition, 2020.

UNIT 1

Refraction of Irregular Reflex, Accommodation & Convergence –: Far Point, Near Point, Ranges, Amplitude of Accommodation

- **Definition**: Occurs when the retinal reflex during retinoscopy appears distorted, dull, or irregular due to media opacities or irregular astigmatism.
- **Significance**: Indicates disrupted optical clarity; seen in conditions like corneal scars, keratoconus, or dense cataracts. Makes accurate measurement of refractive error challenging

UNIT 2

Accommodation & Convergence –: Far Point, Near Point, Ranges, Amplitude of Accommodation

- **Far Point**: The most distant point at which an object is seen clearly when accommodation is relaxed.
- **Near Point**: The closest point at which an object is seen clearly with active accommodation.
- **Range of Accommodation**: Distance between far and near points.
- **Amplitude of Accommodation**: The dioptric difference between the far point and near point; reflects the eye's ability to focus from distance to near.

UNIT 3

Accommodation & Convergence –
Methods of Measurement, NPA, AC/A Ratio

- **Methods of Measurement**: Includes push-up method (measuring near point by bringing a target closer until blur), push-down, or using special lens techniques.
- **NPA (Near Point of Accommodation)**: The closest point at which the eye can maintain clear focus on an object, assessed clinically.
- **AC/A Ratio (Accommodative Convergence/Accommodation)**: The amount of convergence (measured in prism diopters) per diopter of accommodation; important for evaluating binocular vision disorders.

Retinoscopy – Principle & Method

- **Principle**: Objectively measures refractive error by observing the movement of the retinal reflex when a streak of light is shone into the eye.
- **Method**:
- Examiner projects light into the eye and observes the direction of movement of the red reflex.
- "With" movement: Add plus lenses (hyperopia or low myopia).
- "Against" movement: Add minus lenses (myopia).

- The appropriate lens is placed until the reflex is neutralized, indicating the correction aligns the far point with the examiner's eye.

UNIT 4

Objective Refraction, Subjective Refraction

- **Definition**: Determining refractive error without active input from the patient.
- **Techniques**: Retinoscopy, autorrefraction.
- **Role**: Provides a starting point for subjective refraction, especially useful in children or non-communicative patients

Subjective Refraction

- **Definition**: Fine-tunes optical correction based on the patient's feedback about clarity.
- **Process**:
- Series of lens options are presented in a phoropter or trial frame.
- Patient indicates which lens gives the clearest vision.
- Determines the precise prescription including sphere, cylinder, and axis.
- **Goal**: Achieve optimal visual acuity and patient comfort.

UNIT 5

Cross Cylinder

- **Definition**: Special lens (Jackson Cross Cylinder, JCC) used to detect and refine astigmatism during subjective refraction.
- **Usage**:
- Alternates between two-cylinder axes and powers.
- Patient selects which orientation is clearer, guiding axis and power adjustments for the cylindrical component of the prescription.

Practical's

Practical test of the ability to prescribe glasses in various refractive disorders using various equipment's

Reference Books

1. **Clinical Optics** – A.R. Elkington, Helena Frank, Michael J. Greaney, Wiley-Blackwell, 3rd Edition, 2022.
2. **Principles of Optics and Refraction** – M.L. Aggarwal, Jaypee Brothers Medical Publishers, Latest Edition.
3. **Refraction and Retinoscopy** – P.L. Dhingra, Elsevier, 2nd Edition, 2021.
4. **Optics and Refraction** – Khurana A.K., Jaypee Brothers Medical Publishers, 5th Edition, 2023.
5. **Clinical Refraction** – Irvin M. Borish, Butterworth-Heinemann, 2nd Edition, 2020.
6. **System of Ophthalmology – Vol. 5: Refraction and Binocular Vision** – Sir Stewart Duke-Elder, Henry Kimpton Publishers.
7. **Optician's Manual: Spectacle Fitting and Adjustments** – Clifford W. Brooks & Irvin M. Borish, Butterworth-Heinemann, Latest Edition.
8. **Manual of Optometry** – J.E. Bennett & R.B. Rabbetts, Butterworth-Heinemann, 4th Edition, 2019.

COURSE NAME: Investigative Ophthalmology-2
COURSE CODE: OT-403

UNIT1

Head Posture and Its Significance, Hess Screening and Its Interpretations

Observation of head tilt or turn helps identify underlying ocular motor imbalances, such as muscle palsies or congenital nystagmus. Abnormal head posture may compensate for diplopia or maximize binocular vision by aligning the eyes optimally.

Hess Screening and Its Interpretations

Hess Screen Test objectively maps eye movements on a coordinate grid, revealing restrictions or overactions of extraocular muscles. It's crucial for diagnosing and localizing ocular motility disorders, especially in cases involving cranial nerve palsies.

UNIT2

Pleoptics, Occlusion – Types and Uses

Pleoptics refers to therapeutic vision training, especially for eccentric fixation in amblyopia. It employs light stimulation and exercises to rehabilitate the retina and encourage proper fixation.

Occlusion – Types and Uses

Types: Total (opaque patch), partial (translucent or Bangerter filter), and sectoral occlusion.

Uses: Primarily in amblyopia treatment to force usage of the weaker eye; also used for diplopia management and certain strabismus therapies.

UNIT 3

Nystagmus, A. V. Syndromes, Testing of ARC (**Anomalous Retinal Correspondence**)

Definition: Involuntary, rhythmic oscillation of the eyes.

Investigations: Characterized by waveform (jerk or pendular), direction, and conditions of onset. Assessment helps distinguish between congenital and acquired forms and guides neurological assessment.

A. V. Syndromes

Arteriovenous (A-V) Syndromes: Refers to abnormal connections or interactions between arteries and veins in the retina, such as in Wyburn-Mason syndrome or other retinovascular anomalies; detected via fundus examination and angiography.

Testing of ARC (Anomalous Retinal Correspondence)

Assessment of ARC: Uses tests such as the afterimage test, worth 4-dot test, or Bagolini lenses to determine abnormal sensory adaptation to strabismus, where the brain remaps corresponding retinal points to maintain binocular vision despite misalignment.

UNIT4

Amblyopia, Disorders of Accommodation, Paediatric Visual Acuity Assessment

Definition: Reduced vision in an eye (or rarely, both) with no detectable structural abnormality, usually due to abnormal visual experience (e.g., strabismus, refractive error).
Investigation: Diagnosis based on acuity tests (often using age-appropriate charts in children), evaluation of fixation, and exclusion of organic causes.
Disorders of Accommodation
Types: Insufficiency, excess, or spasm of accommodation.
Investigation: Measurement of near point of accommodation (NPA), amplitude, and dynamic response using lenses and objective methods.
Paediatric Visual Acuity Assessment
Methods: Age-appropriate techniques are crucial.
Infants: Preferential looking tests (Teller Acuity Cards)
Toddlers: Cardiff cards, picture/letter matching
Preschool & older: Snellen, LogMAR charts
Significance: Early and accurate assessment essential for diagnosing amblyopia and refractive errors.

UNIT 5

Paediatric Refraction, Neural Aspects of Binocular Vision
Procedures: Typically requires cycloplegic retinoscopy for accuracy (to neutralize accommodation). Objective and subjective methods must consider cooperation level and age.
Neural Aspects of Binocular Vision
Investigation: Study of the neural pathways (retina, optic nerve, visual cortex) underlying fusion, stereopsis, and suppression.
Tests: Stereopsis tests (e.g., Titmus fly, Randot dots), binocular vision assessment, and electrophysiological studies to understand the integration of signals from both eyes.

Practical's

INVESTIGATIVE OPHTHALMOLOGY

1. Pleoptics
2. Orthoptic Exercises

Reference Books

1. Kanski J.J., Bowling B., *Clinical Ophthalmology: A Systematic Approach*, 9th Edition, Elsevier, 2020.
2. Agarwal K.K., *Ophthalmic Instrumentation and Techniques*, Jaypee Brothers Medical Publishers, 2019.
3. Tripathi B., *Ophthalmic Laboratory Technology*, CBS Publishers, 2018.
4. Parson's *Diseases of the Eye*, 22nd Edition, Elsevier, 2020.
5. Khurana A.K., *Theory and Practice of Optics and Refraction*, 4th Edition, Elsevier, 2018.
6. Benjamin W.J., *Borish's Clinical Refraction*, 3rd Edition, Elsevier, 2019.
7. Duke-Elder S., *System of Ophthalmology*, Vol. 1–3, CBS Publishers, 2017.

UNIT 1

Exophthalmometer, Perimeter (Manual & Automated) , Orthoptics Instruments – Haploscope/Home Devices

- **Purpose:** Measures the anterior protrusion of the eye (proptosis or exophthalmos) relative to the lateral orbital rim.
- **Uses:** Essential for diagnosing and monitoring conditions like thyroid eye disease, orbital tumors, and trauma.
- Perimeter (Manual & Automated)
- **Purpose:** Assesses the visual field (the total area in which objects can be seen in the peripheral vision while the eye is focused on a central point).
- **Types:**
- **Manual Perimeter:** Examiner presents the stimuli manually; assessment relies on technician skill.
- **Automated Perimeter:** Computer-controlled; standardizes testing and automatically records responses. Examples: Humphrey Field Analyzer.
- **Uses:** Detects and monitors glaucoma, neurological diseases, and retinal pathologies.
- Orthoptics Instruments – Haploscope/Home Devices
- **Haploscope:** Projects separate images to each eye for assessment and training of binocular vision, especially for strabismus and amblyopia.
- **Home Devices:** Simplified tools for patient use in vision therapy exercises outside the clinic.
- Heidelberg Retino-tomography (HRT II)
- **Purpose:** Confocal scanning laser system that provides three-dimensional images of the optic nerve head and retina.
- **Uses:** Crucial in assessing optic nerve health, especially in glaucoma diagnosis and monitoring.

UNIT 2

Nerve Fiber Analyzer, Frequency Doubling Perimeter

- **Purpose:** Analyzes the retinal nerve fiber layer (RNFL) thickness, helping in early detection of glaucomatous damage.
- **Types:** Includes scanning laser polarimetry and other advanced imaging modalities.
- Frequency Doubling Perimeter
- **Purpose:** Uses frequency doubling technology to detect visual field loss.
- **Advantages:** Sensitive for detecting early glaucomatous damage, rapid and patient-friendly.

UNIT 3

Non-Contact Tonometer, Heidelberg Analyser

- (Likely "Heidelberg Anomaloscope"), Pachometers
- **Purpose:** Measures intraocular pressure (IOP) using a puff of air, with no physical contact with the eye.
- **Uses:** Widely used for glaucoma screening, especially in primary care and screening settings.
- Heidelberg Analyser (Likely "Heidelberg Anomaloscope")
- **Purpose:** Specialized for color vision assessment; an anomaloscope quantitatively measures the ability to match or discriminate between wavelengths.
- **Uses:** Diagnoses and quantifies color vision defects, especially red-green deficiencies.
- Pachometers
- **Purpose:** Measure the thickness of the cornea (central corneal thickness).
- **Uses:** Important for accurate assessment of intraocular pressure (IOP), eligibility for refractive surgery, and keratoconus diagnosis.

UNIT4

Contrast Sensitivity Tests, Glare Acuity Test

- **Purpose:** Evaluate the ability to discern objects from the background when contrast is reduced.
- **Uses:** Detects subtle visual function deficits not revealed by standard visual acuity tests—significant in cataract, glaucoma, and retinal diseases.
- Glare Acuity Tests
- **Purpose:** Assess visual acuity under glare conditions.
- **Uses:** Important for diagnosing functional impairment in cataract and other media opacities.

UNIT 5

Colour Vision Tests, Dark Adaptometer

- **Purpose:** Detect and classify color vision deficiencies.
- **Types:** Ishihara plates (red-green deficiency), Farnsworth D-15, and anomaloscope.
- **Uses:** Essential for occupational screening and inherited/acquired color vision defect diagnosis.
- Dark Adaptometer
- **Purpose:** Measures the eye's ability to adapt to darkness or low-light conditions.
- **Uses:** Test for rod function; early detection of conditions like retinitis pigmentosa and vitamin A deficiency.

Practical's

OPHTHALMIC INSTRUMENTS AND APPLIANCES

1. Non-Contact Tonometer
2. Slit Lamp: Haag-Streit.
3. Photo-slit lamp
4. Fundus Camera
5. Contrast sensitivity tests
6. Glare acuity tests
7. Colour vision tests
8. Dark adaptometer

Reference Books

1. Agarwal K.K., *Ophthalmic Instrumentation and Techniques*, Jaypee Brothers, 2019.
2. Tripathi B., *Ophthalmic Laboratory Technology*, CBS Publishers, 2018.
3. Kanski J.J., Bowling B., *Clinical Ophthalmology: A Systematic Approach*, 9th Edition, Elsevier, 2020.
4. Parson's *Diseases of the Eye*, 22nd Edition, Elsevier, 2020.
5. Khurana A.K., *Theory and Practice of Optics and Refraction*, 4th Edition, Elsevier, 2018.

SEMSETER-V

COUSE NAME: CLINICAL & ADVANCED OPTICS & ORTHOPTICS-1

COURSE CODE: OT-501

UNIT 1

- Orthoptics – General Concept, Ocular Muscles and Movements, AC/A Ratio, Measurement of Angle of Squint
- **Orthoptics** is the branch of eye care dedicated to diagnosing and non-surgically managing binocular vision disorders, strabismus, amblyopia, and eye movement disorders. Orthoptists use specialized tests and therapies, often in collaboration with ophthalmologists, to restore and optimize binocular vision.
- **Ocular Muscles and Movements:**
  Focuses on the anatomy and physiology of the extraocular muscles, which control eye movement, and their intricate neural innervation. Understanding both the muscle actions and their coordinated movements (versions, ductions, and vergences) is essential for assessing motility disorders.
- **AC/A Ratio:**
  The Accommodative Convergence/Accommodation (AC/A) ratio quantifies how much convergence (eye turning inward) occurs per UNIT of accommodation (focusing effort). It is vital for diagnosing convergence excess or insufficiency and tailoring treatment for esotropia and exotropia.
- **Measurement of Angle of Squint:**
  Involves quantifying eye misalignment using methods like the cover test, prism cover test, and corneal reflex assessments. Accurate measurement guides the management of strabismus.
- **Latent Squint (Heterophoria):**
  Refers to a tendency toward eye misalignment that is normally controlled by the brain. It becomes evident only when binocular vision is disrupted, such as during a cover test.

UNIT 2

Maddox Rod, Maddox Wing, Synoptophore, Manifest Concomitant Squint

- **Maddox Rod:**
  A diagnostic tool composed of parallel cylindrical lenses that transform a point of light into a line image, allowing precise detection and measurement of phorias and tropias during binocular vision assessment.
- **Maddox Wing:**
  A handheld device used to measure horizontal and vertical phorias at near. It is commonly used in orthoptic clinics for diagnosing latent deviations.
- **Synoptophore:**
  A versatile instrument for measuring and treating strabismus and binocular vision abnormalities. It

provides controlled visual stimuli for each eye and allows assessment of fusion, suppression, and abnormal retinal correspondence.

- **Manifest Concomitant Squint (Strabismus):**
  A manifest deviation of the eyes (tropia) where the angle of deviation remains consistent in all gaze directions. It is the most common form of strabismus seen in children.

UNIT 3

Squint Concomitant, Paralytic Squint, Head Posture and Its Significance, Hess Screening and Interpretations, Pleoptics

- **Concomitant Squint:**
  A type of strabismus in which the angle of deviation does not change with gaze direction.
- **Paralytic Squint:**
  Caused by paralysis or paresis of one or more extraocular muscles, resulting in variable squint angle, restricted eye movement, and often diplopia.
- **Head Posture and Its Significance:**
  Abnormal head postures (tilt, turn, chin up or down) may indicate compensation for ocular misalignment or muscle palsy and help localize the affected muscle or nerve.
- **Hess Screening and Interpretations:**
  The Hess Screen test maps ocular movements, identifying underacting (paretic) and overacting muscles in restrictive or paralytic strabismus, helping localize affected cranial nerves or muscles.
- **Pleoptics:**
  Pleoptics involves retraining or stimulating the retina in cases of eccentric fixation, especially for amblyopia, using instruments and exercises to restore central fixation.

UNIT 4

Occlusion, Nystagmus, A–V Syndromes, Testing of ARC, Amblyopia

- **Occlusion – Types and Uses:**
  Occlusion therapy (patching) includes total, partial, and sectoral occlusion. It is mainly used for managing amblyopia, controlling diplopia, or post-surgical recovery after squint correction.
- **Nystagmus:**
  An involuntary rhythmic oscillation of the eyes. Orthoptic assessment helps characterize its type (congenital or acquired) and guides prognosis and management.
- **A–V Syndromes (A–V Patterns in Squint):**
  A–V syndromes involve variation in the angle of strabismus with upgaze or downgaze. In A-pattern squint, deviation increases in downgaze, while in V-pattern it increases in upgaze. Recognition is crucial for surgical planning.
- **Testing of ARC (Anomalous Retinal Correspondence):**
  ARC is a sensory adaptation in some strabismus patients where the brain re-maps visual direction to avoid diplopia. Tests include the Worth four-dot test, Bagolini striated lenses, and the after-image test.

- **Amblyopia:**
  A decrease in vision in an eye with no detectable organic cause, usually arising from strabismus or anisometropia in early life. Orthoptic management focuses on occlusion therapy and vision exercises.

UNIT 5

Disorders of Accommodation, Paediatric Visual Acuity Assessment

Disorders of Accommodation:

Include conditions such as accommodative insufficiency, excess, and infacility. Assessment involves measuring accommodative amplitude and facility, which guide management strategies.

Paediatric Visual Acuity Assessment:

Orthoptists use age-appropriate methods such as preferential looking; Cardiff acuity cards, matching tests, and standard charts adapted for children. Early detection is crucial for managing developmental visual deficits.

Paediatric Refraction:

Cycloplegic and age-appropriate refraction techniques are used for accurate assessment in children, often followed by orthoptic evaluation to identify amblyogenic factors.

Neural Aspects of Binocular Vision:

Involves afferent and efferent neural pathways, reflexes (fusion, accommodation, convergence), and higher visual processing centers. Understanding neural integration is essential for diagnosing complex binocular and motility disorders.

Practical's

A. Clinical & Advanced Optics
   1. Refraction And Prescription Of Glasses In Independent Cabin

B. Contact Lens
   1. Contact Lens Fitting
   2. Counselling To Contact Lens Patient
   3. Post-Fitting Instructions
   4. Remedy Of Post-Fitting Problems

Reference Books

1. **Clinical Optics** – A. R. Elkington, Helena J. Frank, and Michael J. Greaney, 4th Edition, Wiley-Blackwell.
2. **Orthoptics and Ocular Motility: Theory and Management of Strabismus** – Eileen E. Birch & Helen S. Spencer, Mosby.
3. **Principles and Practice of Ophthalmic Optics** – M. Jalie, ABDO Publishers.
4. **Textbook of Orthoptics** – S. M. Agarwal & S. Agarwal, Jaypee Brothers Medical Publishers, New Delhi.
5. **Clinical Procedures in Primary Eye Care** – David B. Elliott, 5th Edition, Elsevier.

COUSE NAME: Contact Lenses
COURSE CODE: OT-502

UNIT 1

History of Contact Lens, Corneal Anatomy and Physiology, Corneal Physiology and Contact Lens, Preliminary Measurements and Investigations, Slit Lamp Bio microscopy Contact Lens materials

UNIT 2

Optics of the Contact Lens, Glossary of Terms: Contact Lenses, Indications and Contra Indications Contact Lens, Rigid gas permeable contact lens design, Soft Contact lens design & manufacture, Kertometery, Placido's disc, Tonography, Fitting philosophies, Fitting of Spherical SCL and effect of parameter changes, Astigmatism correction options

UNIT 3

Fitting Spherical RGP contact Lenses, Low OK, High OKEffects of RGP contact Lens parameter changes on lens fitting, Fitting in Astigmatism (Sph RGP), Follow-up post fitting examination, Follow-up Slit Lamp examination, Fitting in KeratoconusFitting in Aphakia, Pseudophakia, Cosmetic Contact Lenses, Fitting Contact Lens in children, Toric Contact Lenses, Bifocal Contact Lenses, Continuous wear and extended wear lenses Therapeutic Lenses/Bandage lenses, Contact lens following ocular surgeries

UNIT4

Disposable contact lenses, frequent replacement and Lenses Use of SpecularMicroscopy and Pachymetry in Contact Lenses, Care & maintenance of Contact Lenses, Contact Lens modification of finished lenses, Instrumentation in contact lens practice

UNIT 5

Checking finished lenses parameters
Recent developments in Contact lenses
Review of lenses available in India

Practical's

Orthoptics & Pleoptics

CLINICAL & ADVANCED ORTHOPTICS

1. Manifest squint workup
2. Paralytic squint workup

Reference Books

1. Contact **Lens Manual: A Practical Guide to Fitting** – Caroline H. & Andre M., Elsevier, 5th Edition, 2022.
2. Contact **Lens Practice** – Nathan Efron, Elsevier, 4th Edition, 2023.
3. Contact **Lenses** – Mandell R.B., Charles C. Thomas Publisher, 5th Edition, 2019.

4. Clinical **Manual of Contact Lenses** – Edward S. Bennett & Vinita Allee Henry, Lippincott Williams & Wilkins, 5th Edition, 2021.
5. Contact **Lens Complications** – Nathan Efron, Elsevier, 3rd Edition,2019.

COURSE NAME: Community Ophthalmology & Eye Camps

COURSE CODE: OT-503

UNIT1

Concepts and Introduction to Community Ophthalmology

- Concepts of Community Ophthalmology – I
- Concepts of Community Ophthalmology – II
- The Epidemiology of Blindness (General Principles) – I
- The Epidemiology of Blindness (General Principles) – II

UNIT 2

Epidemiology of Blindness (Disease-Specific Strategies)

- The Epidemiology of Blindness (Disease Specific Strategies) – III
- The Epidemiology of Blindness (Disease Specific Strategies) – IV

UNIT 3

Survey and Screening Methods

- Survey Methodology – I
- Survey Methodology – II
- Survey Methodology – III
- Screening Procedures in Ophthalmology – I
- Screening Procedures in Ophthalmology – II
- School Eye Screening Programme

UNIT 4

Primary Eye Care and Outreach Programs

- Primary Eye Care
- Organization of Outreach Services
- Organization of Reach-in Programme

UNIT 5

Health Communication, Rehabilitation, and National Programs

- Information, Education, and Communication (IEC)
- Rehabilitation of the Visually Handicapped
- National Programme for Control of Blindness – I
- National Programme for Control of Blindness – II
- Vision 2020: The Right to Sight

Practical's

Community Work

COMMUNITY OPHTHALMOLOGY

1. Eye Screening Programme & Surveys
2. Eye camp (approx. 3) of 10 days each
3. PHC posting

Reference Books:

1. **Community Ophthalmology** – A.K. Khurana, CBS Publishers & Distributors, 3rd Edition, 2021.
2. **Park's Textbook of Preventive and Social Medicine** – K. Park, Bhanot Publishers, 27th Edition, 2023.
3. **Ophthalmology** – Kanski J.J. & Bowling B., Elsevier, 9th Edition, 2020.
4. **Community Eye Health** – Gordon J. Johnson & Robin M. Emerson, Oxford University Press, 2018.
5. **Comprehensive Ophthalmology** – A.K. Khurana, CBS Publishers & Distributors, 7th Edition, 2022.
6. **Preventive and Social Medicine for Paramedical Students** – S. Sunder Lal, CBS Publishers, 2nd Edition, 2020

COURSE NAME: Investigation in Clinical Ophthalmology
COURSE CODE: OT-504

UNIT 1

- Emmetropia & Ammetropia-Aetiology, Population.
- Distribution, Growth of eye, Myopia, Hypermetropia, Astigmatism, Aphakia/Pseudo-phakia.

UNIT 2

- Presbyopia
- Keratoconus
- Post-Op. Refractive errors
- Refraction of irregular reflex

UNIT 3

- **Accommodation & Convergence** – Far point, near point, range, amplitude of accommodation, Accommodation & Convergence. Methods of measurements. NPA. AC 1 A ratio.

UNIT 4

- Retinoscopy-
- Principle & Methods, Objective Refraction Subjective Refraction

UNIT 5

- Cross Cylinder

Practical's

Refraction

- A Clinical and Advanced Refractions
- Refraction and Prescription of glasses
-

Reference Books

1. Khurana A.K. – *Comprehensive Ophthalmology*, Jaypee Brothers.
2. Ahuja R.B. – *Textbook of Ocular Physiology*, CBS Publishers.
3. Adler's Physiology of the Eye – *Leonard A. Levin et al.*, Elsevier.
4. Kanski's Clinical Ophthalmology – *Brad Bowling*, Elsevier.
5. Basic and Clinical Science Course (BCSC) – *American Academy of Ophthalmology.*

SEMESTER-VI

COURSE NAME: CLINICAL & ADVANCED OPTICS & ORTHOPTICS – 2

COURSE CODE: OT-601

UNIT 1

Basic Concepts of Refraction

1. Emmetropia & Ametropia
   – Definition, Aetiology
   – Population distribution
   – Growth and development of the eye
2. Far point, Near point, Range & Amplitude of Accommodation (Intro concepts)

UNIT 2

Refractive Errors (Spherical & Cylindrical)

1. Myopia– Types, Causes, Clinical features, Management
2. Hypermetropia – Types, Causes, Clinical features, Management
3. Astigmatism – Regular & Irregular, Clinical signs, Correction
4. Presbyopia – Aetiology, Symptoms, Add calculation
5. Aphakia / Pseudophakia – Signs, Optical considerations
6. Keratoconus – Pathophysiology, Clinical features, Optical management
7. Post-operative refractive errors – Post-cataract / Post-LASIK / Post-RK errors
8. Refraction of Irregular Reflex Clinical handling & techniques

UNIT 3

Accommodation & Convergence

1. Accommodation & Convergence – I
   – Physiology
   – Far point, Near point
   – Range & Amplitude of accommodation (detailed)
2. Accommodation & Convergence – II
   – Methods of measurement
   – NPC, NPA
   – AC/A ratio (calculation & interpretation)

UNIT4

Objective Refraction Techniques

1. Retinoscopy – Principle & Methods
   – Static & Dynamic retinoscopy
   – Streak vs Spot
   Neutralization techniques
2. Objective Refraction
   – Autorefraction

– Photorefraction
– Wavefront aberrometry
– Interpretation of printouts

UNIT5

Subjective Refraction & Advanced Techniques

1. Subjective Refraction
   – Monocular & Binocular balancing
   – Duochrome test
   – Jackson cross cylinder steps
2. Cross Cylinder (JCC)
   – Principle
   – Technique
   – Axis & power refinement
3. Final prescription

Special considerations in children, elderly, and post-op patients

Practical's

Refraction

1. Objective refraction techniques

- Performing static and dynamic retinoscopy for assessment of refractive status.
- Identifying neutralization, correcting refractive errors, and interpreting reflex patterns.

2. Subjective refraction procedures

- Determining best corrected visual acuity (BCVA) using step-by-step refinement.
- Performing monocular and binocular balancing, duochrome test, and JCC (cross-cylinder) refinement.

3. Assessment of accommodation & convergence

- Measuring NPA, NPC, amplitude, and AC/A ratio using standard clinical methods.
- Interpreting clinical findings related to accommodative and convergence anomalies

References

1. Borish's Clinical Refraction – William J. Benjamin
2. Clinical Optics – A. R. Elkington, Helena Frank, Michael Greaney
3. Optics and Refraction – A. K. Khurana
4. Ophthalmic Optics – M. Jalie
5. Clinical Orthoptics – Fiona Rowe
6. Binocular Vision & Ocular Motility – Gunter K. Von Noorden
7. Foundations of Binocular Vision – Schwartz

UNIT-1

- Emmetropia&Ammetropia-Aetiology
- Population
- Distribution
- Growth of eye
- Myopia
- Hypermetropia
- Astigmatism
- Aphakia/Pseudo-phakia
- Presbyopia
- Keratoconus

UNIT-2

Post-Op. Refractive errors, Refraction of irregular reflex, Accommodation & Convergence –

1. Far point, near point, range, amplitude of accommodation. Accommodation & Convergence
2. Methods of measurements, NPA, AC/ A ratio.

Retinoscopy -Principle & Method

UNIT-3

Objective Refraction Subjective Refraction, Cross Cylinder, Low-Vision aids: Techniques & microscopes

UNIT-4

Rehabilitation of blinds

Practical's

COMMUNITY WORK

Eye Bank

1. How to donate your eyes/Counselling
2. Collection of eyes
3. Preservation of eyes

Reference Books

1. Khurana A.K. – *Comprehensive Ophthalmology*, CBS Publishers
2. Ghai C.L. – *A Textbook of Practical Physiology*, Jaypee Brothers
3. Kanski J.J. – *Clinical Ophthalmology: A Systematic Approach*, Elsevier
4. Parson's – *Diseases of the Eye*, Butterworth-Heinemann
5. Pelczar M.J. – *Microbiology: Applications and Concepts*, McGraw Hill

UNIT-1

Publicity

Public awareness plays a crucial role in increasing rates of eye donation. Awareness campaigns should address myths (such as religious objections or fears of disfigurement) and inform the public about the process, the need for corneal tissue, and how donated eyes benefit recipients. Counselling for families in hospital wards, rather than mortuaries, is shown to be more effective. It is important to emphasize that eye donation does not cause disfigurement and is supported by all major religions.

UNIT-2

How to donate your eyes- Any individual can pledge to donate their eyes through various organizations, hospitals, or eye banks. Adult individuals or families can register their intent during life or consent to donation after death. After the donor's death, the family should contact an eye bank or hospital, ideally within 4–6 hours, to ensure corneal tissue viability. There is no age limit, and vision quality generally does not disqualify someone from donating.

Collection of eyes -Eyes (more specifically, corneas) are preferably collected within **4–6 hours after death**. The collection team may visit the deceased's location or the body may be transported to an eye bank. The removal of corneal tissue is done with sterile instruments by trained professionals and does not cause facial disfigurement.

UNIT-3

Preservation of eyes -Immediately after removal, the **cornea or whole eye** is preserved in a specialized storage medium and kept at 2–8°C (hypothermic storage) or in organ culture at 28–37°C. Hypothermic storage is common in North America while organ culture is often used in Europe. Solutions used contain chondroitin sulfate, antioxidants, and nutrients to sustain tissue viability

UNIT-4

Pre-operative Instructions

- Families should **close the eyelids** of the deceased and cover them with a moist sterile cloth or pad to prevent drying. They should avoid applying pressure to the eyes and switch off any ceiling fans or AC blowing directly at the body. The body should be kept cool but not frozen. Contact the nearest eye bank as quickly as possible.

Post-operative Instructions

- After removal, the donor's eyelids can be gently closed, and the face will not appear disfigured. Grief counselling or further support may be offered to the family. For recipients, post-operative instructions after transplantation include using prescribed eye drops, avoiding eye rubbing or heavy exercise, and attending regular follow-ups with the ophthalmologist.

UNIT-5

Latest techniques for preservation of donor cornea

- **Modern techniques** include:
  - **Hypothermic storage (2–8°C):** Widely used, maintains the cornea for up to 14 days.
  - **Organ culture (28–37°C):** Used in Europe, allows preservation for up to 4 weeks and better detection of potential contamination.
  - **Cryopreservation:** Storage below −80°C for long-term preservation, mainly for partial-thickness grafts (e.g., for deep anterior lamellar keratoplasty), but may cause endothelial damage.
  - **Glycerol preservation:** Allows storage at room temperature for years; mainly for non-viable corneal tissue used in tectonic or therapeutic procedures, as the endothelium does not survive this method.
  - **Specialized media (e.g., McCarey-Kaufman medium):** Used for moist-chamber or specific storage protocols to enhance tissue viability and extend shelf life.

Practical's

Assistance In Clinical Ophthalmology & OT

Investigations In Clinical Ophthalmology

1. Dark Adaptometry
2. A Scan Biometry
3. Contrast Sensitivity
4. Perimetry
5. Keratometry
6. Focimetry
7. ERG/EOG/VER

Reference Books

1. Khurana A.K. – *Comprehensive Ophthalmology*, Jaypee Brothers.
2. Ahuja R.B. – *Textbook of Ocular Physiology*, CBS Publishers.
3. Adler's Physiology of the Eye – *Leonard A. Levin et al.*, Elsevier.
4. Kanski's Clinical Ophthalmology – *Brad Bowling*, Elsevier.
5. Basic and Clinical Science Course (BCSC) – *American Academy of Ophthalmology.*

COURSE NAME: Management of OT

COURSE CODE: OT-604

UNIT 1

Introduction to Ocular in General

- **Ocular (eye) care** spans the diagnosis, treatment, and surgical management of eye health and diseases. It involves specialized **operating theaters (OT)**, instruments, **aseptic techniques**, and rigorous sterilization to prevent infection.

UNIT 2

Asepsis: How to Achieve

- Achieving **asepsis** involves creating a sterile environment free from pathogens.
- Methods include hand hygiene, wearing sterile gloves/gowns/masks, sterilizing instruments, disinfecting surfaces, and maintaining appropriate airflow and filtration systems in OT.
- Adhering strictly to **infection control protocols** is vital to avoid postoperative complications.

Anaesthetic Agents and Where Indicated

- **Topical anesthesia** (drops or gels): Used in procedures like cataract surgery and minor surface interventions for quick, pain-free results.
- **Local anesthesia** (peribulbar/block): Indicated for longer intraocular surgeries.
- **General anesthesia**: Reserved for children, uncooperative adults, or complex surgeries.
- Selection depends on the **procedure, patient health, and desired surgical exposure**.

UNIT 3

OT Sterilization Procedures

- **Operating theaters** require regular cleaning and disinfection of all surfaces (floors, walls, tables).
- Air filtration (HEPA filters), positive pressure ventilation, scheduled fumigation, and strict control of personnel movement help maintain sterility.
  Daily and terminal (end-of-day) cleaning are routine.

UNIT4

Sterilization Procedures of OT Instruments

- **Steam sterilization (autoclave)** is the most reliable and widely used method for ophthalmic instruments.

- **Chemical sterilization** (for heat-sensitive items) uses agents like ethylene oxide (EO), which fully permeate and sterilize but require special handling.
- Both *wrapped* and *unwrapped* instrument loads are sterilized, with wrapped items offering longer shelf life.
- Instruments are **decontaminated** (removal of blood, organic and inorganic matter) before sterilization, as debris can impede sterilizing agents1.
- Short-cycle steam sterilization is validated for same-day surgery use when following manufacturer's guidelines.

UNIT-5

Maintenance of Instruments and Equipment: Ophthalmic Instruments

- Clean thoroughly with water and appropriate detergents (preferably non-enzymatic for intraocular instruments).
- Regular oiling with silicone or sewing machine oil for hinged instruments (weekly).
- Store instruments dry and in organized trays/cases with protectors to prevent damage or rusting Maintenance of Instruments and Equipment: Orthoptics Instruments
- Regular dusting, cleaning of mechanical parts, and calibration as per manufacturer's guidelines maintain accuracy and prevent malfunction.
- Store in dry, clean environments and check for wear or misalignment.
- **Maintenance of Instruments and Equipment: Surgical Instruments**
- **Sharpen scissors** and realign forceps as needed; use professional services when required.
- Replace instruments showing signs of corrosion or irreparable damage.
- For transport, use protective trays, rolls, or instrument cases ensuring they do not touch or pile atop each other.
- **Maintenance of Instruments and Equipment: Optometric & Contact Lens Equipment**
- Disinfect lens racks and chin/headrests between patients.
- Clean lenses with lens-safe agents.
- For contact lens practice, meticulously disinfect trial lenses and fitting sets after each use to prevent cross-infection.

Practical's

Ophthalmic Instruments and Appliances

1. Lensometer, Lens Gauge
2. Tonometer
3. Placido Disc
4. Keterometer
5. Specular Microscopy
6. Exophthalmometer
7. Perimeter

Reference Books

1. Ahuja R.B. – Textbook of Ocular Physiology, CBS Publishers.
2. Adler's Physiology of the Eye – Leonard A. Levin et al., Elsevier.
3. Kanski's Clinical Ophthalmology – Brad Bowling, Elsevier.
4. Khurana A.K. – Comprehensive Ophthalmology, Jaypee Brothers.
5. Basic and Clinical Science Course (BCSC) – American Academy of Ophthalmology.