SARDAR PATEL UNIVERSITY

First Year B.Sc Optometry

Sr. No	Subject	Code	Duration of Uni. Exam	External Marks	Internal Marks	Total
1	Anatomy (Human & Ocular)	BOPT-101	3	80	20	100
2	Anatomy (Human & Ocular) (P)	BOPT - 101(P)	-	40	10	50
3	Physiology (Human & Ocular)	BOPT – 102	3	80	20	100
4	Physiology (Human & Ocular) (P)	BOPT – 102(P)	-	40	10	50
5	Physical Optics	BOPT – 103	3	80	20	100
6	Geometrical Optics	BOPT – 104	3	80	20	100
7	Physical Optics & Geometrical Optics (P)	BOPT – 105 (P)	-	80	20	100
8	Biochemistry	BOPT – 106	3	80	20	100
	Grand Total					**700**

FIRST YEAR BACHELOR OF OPTOMETRY (B.OPTOM.)
SUB: ANATOMY (HUMAN & OCULAR)

Scope & Objective:

Anatomy, histology and physiology are introduced by terms and elementary principles based upon simple biology. Knowledge of normal physiology is the necessary pre requisite to understand the abnormal state of functions of organs in disease. The course aims at imparting to the students the basic structure and functioning of the human body, adequate enough to equip them to better understanding of other subjects like general and ocular biochemistry, pathology, microbiology, neuro-ophthalmic investigations, systemic diseases and the eye.

Lectures should be designed keeping in mind a balanced presentation of the unified working of the body system with special examples taken from depatures from normal health. Ocular examples should be used as and when appropriate.
The scope of the course is in keeping with the limited objectives of the knowledge and skill expected of a graduate in optometry. At the end of the course the student is expected to be able to describe the salient features of the tissues of the body. The topography of the constituents of the organ system, their structural relationships and basic functions.

HUMAN ANATOMY:

Note:- **For the concern of the subject of the Human Anatomy for the bachelor course of Optometry , the teaching level should be preliminary.**

1. INTRODUCTION ANATOMY
   Anatomy and its subdivision, planes of the body, terms in relationship of structures, regional anatomy and organ systems.

2. TISSUES OF THE BODY : (Histology of body tissues)
   -Epithelium
   -Connective tissue
   -Bone and cartilage
   -Muscles: skeletal, plain, heart muscle
   -Blood vessels
   -Neuron, neuralgia
   -Glands, exocrine and endocrine

-Skin and appendages
Lymphoid tissues

3. ORGAN SYSTEMS :

Locomotor system: bones, muscles, joint.
Spource of Cnanial Nerve
Cranial Nerves (I to XII)

HUMAN ANATOMY PRACTICALS:

- Identification of Organs
- Skull

OCULAR ANATOMY

Scope and Objective

A through understanding of the anatomical structure and functions of the eye. it should also include effects of the cranial nerves, sympathetic and para-sympathetic nervous systems on the eye. At the end of this course, the student should be able to describe the silent features of the structure of the eye and it's adnexa, related nervous system and correlate these with the functions of the whole body.

Note: - For the concern of the subject of the Ocular Anatomy for the bachelor course of Optometry, the teaching level is likely to be detail.

Text and reference Books

(1) Anatomy & physiology of eye –A.K.khurana
(2) Anatomy of eye and adnexa –H.V.Nema

(3) Physiology of the eye- Adler H - 4th edition 1980
(4) Functional Anatomy and Histology of Eye - Gordon Ruskell, Butterworth Heinemann.
(5) Ocular Anatomy - Arvind Eye Hospital , Madurai.
(6) Diagnosis of Defective colour vision-Jennie Brich
(7) Clinical Anatomy of Visual system-Lee Ann Remington, Butterworth Heinemann.
(8) Clinical Ocular Physiology - Nagi Hang Victor Chong, Butterworth Heinemann.

Eye Anatomy

1. Outline of visual system – overall view
2. Anatomical parts –Terminology, anterior & posterior segments and chambers
3. Adnexa and orbit- constituent bones –properties, function
4. Orbital openings, contents and their relationships
5. Three coats of eyeball-Outer ,Middle, Inner
6. Conjunctiva-regions, layers, functions, significance
7. Sclera-regions, layers, functions, significance
8. Cornea-regions, layers, functions, significance
9. Limbus- regions, layers, functions, significance
10. Middle Coat- Uvea – Choroid, Iris, Pupil
11. Ciliary body,ciliary muscles,processes-layers,functions,significance
12. Iris- Regions, structure, functions, significance and variations of colour

13. Anterior chamber- Structure ,depth significance ,Anterior chamber angle-regions
14. Crystalline lens-Structure, growth, function, significance
15. Posterior chamber contents and significance
16. Vitreous humor – Contents, significance
17. Retina- Anatomical structure, Layers –significance ,distribution of rods and cones
18. Different regions of retina and retinal representation in brain
19. Blood supply of all parts of eye and adnexa
20. Cranial nerve supply of the eye
21. Motor nerves to the eye and adnexa
22. Visual path way-complete structure ,significance
23. Optic tract, Optic chiasma, Lateral geneculate body, optic radiations ,area 17
24. Ocular Embryology-general outline

OCULAR ANATOMY PRACTICALS

(1) **Eye:** Practical dissection of bull's eye or Human's eye
(2) **Orbit:** Practical demonstration of orbital structures.

FIRST YEAR BACHELOR OF OPTOMETRY (B.OPTOM.)
SUB: PHYSIOLOGY (HUMAN & OCULAR)

HUMAN PHYSIOLOGY

Scope and Objective:

Human Physiology is introduced by terms and elementary principles based upon simple biology. Knowledge of normal physiology is the necessary pre-requisite to understand the abnormal state of functions of organs in diseases. The course aims at imparting to the students the basic structure & functioning of the human body.

Text and reference Books:

1. Anatomy & Physiology by Toratora
2. Physiology by Vijaya Joshi
3. Concise Medical Physiology by Sujit K. Chaudhary
4. Medical Physiology by Arthur C. Guyton

Note: - For the concern of the subject of the Human Physiology for the bachelor course of Optometry, the teaching level should be preliminary.

LECTURE TOPICS

1. Cell Physiology
2. Genes chromosomes, Inheritance and human variations, Mutations
3. Homeostasis
4. Transport through cell membranes
5. Membrane Potentials

NERVE MUSCLE PHYSIOLOGY

1. Neuron / Nerve classification
2. Nerve impulse Generation Exitation chronaxie
3. Conduction and properties
4. Skeletal muscle structure classifications
5. Mechanism of contractions
6. Properties of muscle
7. Neuromuscular junction

BLOOD

1. Functions, Plasma proteins, Volume regulation
2. Component cells: - WBCs, RBCs – Structure, functions, formation and life span

3. Blood Groups
4. Immune System: -.Lymphocytes, immunoglobulin, complement, transplant rejection, MHC, AIDS
5. Coagulation: - Mechanism, factors of blood clotting, platelets

CARDIO VASCULAR SYSTEM

1. Heart: - structure, properties and functions
2. Conduction system
3. Cardiac cycle
4. ECG
5. Definitions, Control of arterial blood pressure, factors affecting
6. Pulse: - measurement, control and clinical significance

CENTRAL NERVOUS SYSTEM

1. Sense organs: - Classification, structure, functions and types of pain
2. Reflexes: - Definitions and some somatic reflexes of clinical importance
3. Somatic, sensory and motor pathways
4. Functions of Brain: - cortex, motor and sensory
5. Motor control: - cerebellum and basal ganglia functions
6. Functions of hypothalamus, thalamus and brainstem
7. Sleep and consciousness
8. Memory
9. Autonomic nervous system: - definition, structure, general principles and functions
10. Special senses: - eye, auditory apparatus, olfactory sense organs, gustatory sense organs

PRACTICALS

1. CARDIOVASCULAR SYSTEM
   - Clinical examination of circulatory system
   - Measurement of blood pressure and pulse rate.
   - Effect of exercise on blood pressure and pulse rate.

2. CENTRAL NERVOUS SYSTEM
   - Sensory system
   - Motor system
   - Cranial system
   - Superficial and deep reflexes.
   - Test for hearing.

OCULAR PHYSIOLOGY

The study of ocular physiology is basic and fundamental in Optometric curriculum. The object of the course is to make the students understand thoroughly the functional mechanisms of visual apparatus.

Text and reference Books:

1. Anatomy and physiology – A.K.Khurana
2. Adler's Physiology of eye –Moses & Hart

Note:- **For the concern of the subject of the Ocular physiology for the bachelor course of Optometry , the teaching level is likely to be detail.**

1. Protective mechanisms of the eye: Eye lids and lacrimation, description of the globe.
2. Extrinsic eye muscles, their actions and control of their movements.
3. Cornea: metabolism and transparency.
4. Aqueous humor: Secretion, normal composition, drainage.
5. Intra ocular pressure: significance. normal features, age variations
6. Intra ocular pressure methods of measurement – outline and significance
7. Pupil: Pupillary actions, reflex to light –significance in sleep and coma
8. Crystalline lens and accommodation-presbyopia.
9. Retina-Rhodopsin cycle and retinal metabolism - outline
10. Vision-general aspects of sensation.
11. Pigments of the eye and photochemistry.
12. The visual stimulus, refractive errors.
13. Visual acuity, vernier acuity and the principals of measurement.
14. Visual perception-Binocular vision, stereoscopic vision, optical illusions.
15. Visual pathway, central and cerebral connection.
16. Color vision and color defects. Theories and diagnostic tests..

17. Introduction to Electro Physiology.

18. Scotopic and Photopic Vision

19. Color vision, Color mixing

20. Mechanism of accommodation

21. Retinal sensitivity and Visibility

22. Receptive stimulation and flicker

23. Ocular, movements and saccades

24. Visual perception and adaptation

25. Introduction to visual psychology (Psychophysics)

OCULAR PHYSIOLOGY- PRACTICALS.

EYE AND VISION

i. Lid movements
ii. Tests for lacrimation tests
iii. Extraocular movements
iv. Pupillary reflexes
v. Digital tonometry
vi. Schiotz tonometry
vii. Measurement of accommodation
viii. Visual acuity measurement.
ix. Direct ophthalmoscopy (Observation)
x. Indirect ophthalmoscopy (Observation)
xi. Retinoscopy
xii. Light and dark adaptation.
xiii. Binocular vision.
xiv. Color Vision
xv. Near Point of Convergence

FIRST YEAR BACHELOR OF OPTOMETRY (B.OPTOM.)
SUB: BIOCHEMISTRY (BASIC & OCULAR)

BASIC BIOCHEMISTRY

(1) Carbohydrates-
- (i) Basic properties and importance of monosaccharide (mainly Glucose, Fructose, Galactose)
- (ii) Disaccharides: Sucrose, Lactose, Maltose
- (iii) Homo-polysaccharides: Starch & Glycogen:
- (iv) Mono-polysaccharides and their importance.
- (v) Osazone, Amino sugar, Deoxy sugar, Glycosides: - Basic concept

(2) Proteins:
- (i) Important amino acids in relation to eye.
- (ii) Glutathione:and its functions
- (iii) Plasma proteins and their functions
- (iv) General concept of structure and function immunoglobulin.

(3) Lipids
- (i) Simple compound and derived lipids and their functions.
- (ii) General concept of cholesterol and different lipoproteins alongh with their importance.
- (iii) Glycolipids

(4) Acids and base

General concept – Acidosis/Alkalosis with various buffer systems

(5) Enzymes
- (i) Basic general concept
- (ii) Isoenzyme
- (iii) Enzyme inhibition & medical application
- (iv) Diagnostic importance of enzyme

(6) Vitamins

General concepts about vitamins A, C, E in detail

(7) Nucleotides
- (i) CAMP and GAMP

(8) Body fluids
- (i) Tears and tear films
- (ii) Aqueous and vitreous humors.

OCULAR BIOCHEMISTRY

1. major metabolic pathways of glucose and their relation to disease & eye disease
2. gluconeogenesis & glycolysis metabolic pathways and their relation to disease & eye disease
3. Minor metabolic pathways – Fructose, Sorbitol and their relation to eye disease
4. Metabolic diseases in relation to glucose metabolism mainly diabetes mellitus, cataract etc

5. General concept of metabolic pathways of lipid
6. General concept of metabolic pathways of cholesterol
7. General concept of metabolic pathways of lipoprotein
8. De amination trans-amination formation of urea and related disorder.
9. Disposal of ammonia and toxicity of ammonia.
10. Metabolic disorders of amino acid affecting eye
11. General concept of Hormone action Metabolic role of Hormone in eyewith special importance of protein and steroid hormones.
12. Bilirubin metabolism
13. Jaundice
14. Basic biochemistry of retina
15. Basic biochemistry of cornea
16. Basic biochemistry of lens
17. Basic biochemistry of visual pigments
18. Basic biochemistry of fluids in eye

FIRST YEAR BACHELOR OF OPTOMETRY (B.OPTOM.)
SUB: GEOMETRICAL OPTICS

(1) PHOTOMETRY

Basic concepts and definitions in photometry
Reflection co-efficient, transmission co-efficient, power-transmitted and reflected
Lummer Brodhun photometer
Lens shapes
Vergence and conversion factors,
Divergence and convergence of wave fronts by spherical surfaces
Primary and secondary focal points

(2) REFRACTION THROUGH SPHERICAL SURFACES

Introduction
Refraction matrix, reflection matrix translational matrix for plane and curved surfaces
Spherical refracting interfaces
Convex, concave surfaces
Focal points, nodal points and planes
Symmetry points, imaging examples
Lateral magnification, angular magnification.
Thin lens
Thin lens cardinal points
Lenses in contact separated.
Two-lens systems-reduced system
Thick lenses
Lenses cardinal points
Application to calculate to the equivalent dioptric powers of thick meniscus lenses

(3) ABERRATIONS

Monochromatic aberrations: first order and third order theory.
Chromatic aberrations-dispersion without deviation and deviation without dispersion
Spherical aberrations
Coma
Astigmatism
Curvature of field
Distortion -cause and the methods of minimizing aberrations
Cauchy's Dispersive formula

(4) PRISMS

Thin prisms
Combination of thin prisms

Dispersion by prism
Angular dispersion-dispersive power
Achromatic Prisms
Prisms diopters
Direct vision prism
Reflection & refraction of divergent rays

(5) OPTICS OF THE HUMEN EYE

Vergences and Vergences techniques revised.
Lens power, prism power, and cylindrical lenses
Gull strand's schematic eyes
Visual acuity
Stile Crawford experiment
Binocular telescopes
Emmetropia and Ametropia
Correction of spherical Ametropia
Thin lens model of the eye- angular magnification
Magnification of microscope & telescope
Spectacle and relative spectacle magnification
Aperture stops
Entrance and exit pupils
Spatial distribution of optical information-modulation transfer function (MTF)
Spatial filtering – applications
Special Eye care with VDU

Text and reference Books for optics of human eye

1) Optic in vision, H.Obstefield, Butterworth's, London, 1982.
2) Optics, WHA Finch am, 9th edition , Butterworth's, 1980
3) Optics of human eye - Smith, Aitcheson

Text and reference Books

1) Geometrical & Physical Optics - P. K. Chakrabarti
2) Fundamental of Optics - Francis a. Jenkins & H. E. White (Tata Mc Graw-hill pub.)
3) A Textbook of Optics – N. Subramanyam &Brij lal (S. Chand pub.)

FIRST YEAR BACHELOR OF OPTOMETRY (B.OPTOM.)
SUB: PHYSICAL OPTICS

(1) NATURE OF LIGHT

Newton's Corpuscular Theory
Origin Wave theory of light
Wave Motion
Mathematical representation of wave simple harmonic motion (S.H.M)
Energy of a vibrating particle
Composition of S.H.M. in a straight line and at right angles
Huygen's principal
Laws of reflection and refraction at spherical surfaces and lenses
Quantum theory-dual nature of light
Fermat's principal
The paraxial region
Ray and wave theory

(2) INTERFERENCE

Review of phenomena- Young's experiment, coherent sources, phase and path difference, intensity, Theory of interference fringes (Revision)
Lloyd's single mirror
Interference in thin films-interference due to reflected and transmitted light
Colors of thin films-wedge shaped thin films testing of flatness of surface
Newton's rings experiment-refractive index of liquid
Visibility of fringes
Antireflection coatings
Interference filters
Application of thin film interference
Multilayer air coating

(3) DIFFRACTION

Review of Diffraction –Introduction
Single slit Experiment
Rectilinear propagation of light
Zone plate
Diffraction due to Circular aperture, Straight Edge
Double slit pattern
Multiple slits grating
Reflection grating
Absent Spectra with a Diffraction Grating
Dispersive Power of Grating
Resolving power of optical instruments- telescope, microscope, grating, prism

GEOMETRICAL OPTICS PRACTICAL:

(1) Refraction through a slab.
(2) Caustic curve for a glass slab
(3) I-d curve by prism-pin method
(4) Spherometer
(5) Single optic lever
(6) Spherical mirrors
(7) Spherical lenses
(8) Critical angle-glass and water
(9) Magnifying power of a simple and compound microscope.
(10) Magnifying power of a telescope.
(11) Spectrometer-i.d. curve
(12) Spectrometer-narrow angled prism
(14) Refractive index by microscope
(15) Foci meter of prism, Dispersive power of a prism
(16) Toric lens and meniscus lens
(17) Boy's method-radius of curvature
(18) Liquid lens
(19) Refractive index of lenses.

(4) POLARIZATION

Review of Polarization - Polarization of transverse waves
Polarization by reflection and refraction
Brewster's Law
malus's law
Refraction by Calcite Prisms
Nichol prism
Rochon and Wollaston Prisms
Polarization by selective absorption-dichorism
Study of plane elliptically and circularly polarized light
Optical activity-Fresnel's half shade polarimeter
Metallic reflection
Basic principles of holography

(5) SPECTRUM

Sources of light
Bunsen flame
Carbon arc
Mercury vapour lamp
Sodium vapour lamp
Emission and absorption spectra
Classification of visible-ultraviolet and infra red spectra-electromagnetic spectrum

(6) ABSORPTION AND SCATTERING

Absorption by Solids & liquids & gases
Resonance & Fluorescence of Gases
Fluorescence of Solids and liquids
Introduction - Scattering
Rayleigh's scattering
Raman scattering
Elements of EM theory in vector rotation and propagation of a wave in anisometric medium
Viscosity

NONLINEAR OPTICS

(7) FIBER OPTICS

Introduction
Critical angle, numerical aperture, acceptance angle
Types of optical fibre

Dispersion and attenuation
Applications and Advantages of optical fibre

(8) LASER OPTICS

Characteristics of LASER
Basic laser principle
Spontaneous and stimulated emission
Population inversion
Optical feedback
Coherence-spatial, temporal, laser pumping
Helium-neon laser
Argon Ion laser
Ruby laser
Carbon dioxide laser
Eximer laser
Semi conductor lasers
ND: YAG Laser
Application of LASER in Ophthalmology

(9) OPTICAL INSTRUMENTS

Spectrometer
Simple and compound microscope
Telescopes
Fresnel's Biprism

TEXT AND REFERENCE BOOKS

(1) A TEXTBOOK OF OPTICS – N. SUBRAHMANYAM & BRIJ LAL (S. CHAND PUB.)
(2) FUNDAMENTAL OF OPTICS - FRANCIS A. JENKINS & H. E. WHITE
(3) AN INTRODUCTION TO LASERS THEORY & APPLICATIONS – M. N. AVADHANULU

PHYSICAL OPTICS (PRACTICALS)

1. Fresnel's biprism experiment
2. Thickness of thin glass plate.
3. Newton's Rings-radius of curvature.
4. Newton's Rings-refractive index of liquid.
5. Air wedge
6. Grating-wave length determination.
7. Dispersive power of a grating
8. Diffraction at a straight wire.
9. Resolving power of a telescope
10. Polarimeter
11. Reflective diffraction
12. Resolving Power of Grating