

## B. Optometry Syllabus

### FIRST SEMESTER

| A. THEORY                 |        |   |                            |    |   |           |         |
|---------------------------|--------|---|----------------------------|----|---|-----------|---------|
| SL<br>.N<br>O.            | CODE   | THEORY                                      | CONTACTS<br>(PERIODS/WEEK) |    |   |           | CREDITS |
|                           |        |   | L                          | T  | P | TOT<br>AL |         |
| 1                         | BO-101 | Geometrical Optics<br>(Optics I)            | 3                          | 1  |   | 4         | 4       |
| 2                         | BO-102 | Physiology (General)                        | 3                          | 1  |   | 4         | 4       |
| 3                         | BO-103 | Anatomy (General)                           | 3                          | 1  |   | 4         | 4       |
| 4                         | BO-104 | Basics of Biochemistry                      | 1                          | 1  |   | 2         | 2       |
| 5                         | BO-105 | Professional<br>Communication in<br>English | 1                          | 1  |   | 2         | 2       |
| <b>Total of Theory</b>    |        |   |                            |    |   | 16        | 16      |
| PRACTICAL                 |        |   |                            |    |   |           |         |
| 1                         | BO-191 | Geometrical Optics-1                        |                            |    | 4 | 4         | 4       |
| 2                         | BO-192 | Physiology (General)                        |                            |    | 2 | 2         | 2       |
| 3                         | BO-195 | Effective<br>communication                  |                            |    | 2 | 2         | 2       |
| <b>Total of Practical</b> |        |   |                            |    |   | 12        | 12      |
| <u>Total of Semester</u>  |        |   |                            | 24 |   | 24        |         |

### SECOND SEMESTER

| A. THEORY                 |        |                                  |                            |    |   |           |         |
|---------------------------|--------|----------------------------------|----------------------------|----|---|-----------|---------|
| SL<br>.N<br>O.            | CODE   | THEORY                           | CONTACTS<br>(PERIODS/WEEK) |    |   |           | CREDITS |
|                           |        |                                  | L                          | T  | P | TOT<br>AL |         |
| 1                         | BO-201 | Physical Optics (Optics II)      | 3                          | 1  |   | 4         | 4       |
| 2                         | BO-202 | Ocular Physiology &<br>Nutrition | 3                          | 1  |   | 4         | 4       |
| 3                         | BO-203 | Anatomy (Ocular)                 | 3                          | 1  |   | 4         | 4       |
| 4                         | BO-204 | Environment & Ecology            | 1                          | 1  |   | 2         | 2       |
| 5                         | BO-205 | Computer Fundamentals            | 1                          | 1  |   | 2         | 2       |
| <b>Total of Theory</b>    |        |                                  |                            |    |   | 16        | 16      |
| B. PRACTICAL              |        |                                  |                            |    |   |           |         |
| 1                         | BO-291 | Physical Optics II               |                            |    | 4 | 4         | 4       |
| 3                         | BO-295 | Computer                         |                            |    | 2 | 2         | 2       |
| <b>Total of Practical</b> |        |                                  |                            |    |   | 6         | 6       |
| <u>Total of Semester</u>  |        |                                  |                            | 22 |   | 22        |         |

## B. Optometry Syllabus

### THIRD SEMESTER

| A. THEORY                 |                |   |          |           |   |    |             |
|---------------------------|----------------|---|----------|-----------|---|----|-------------|
| SL<br>.N<br>O.            | CODE           | THEORY  | CONTACTS |           |   |    | CREDIT<br>S |
|                           | (PERIODS/WEEK) |   |          |           |   |    |             |
|                           | L              | T   | P        | TOT<br>AL |   |    |             |
| 1                         | BO-301         | Visual Optics                                       | 3        | 1         |   | 4  | 4           |
| 2                         | BO-302         | Binocular Vision & Ocular Motility                  | 2        | 1         |   | 3  | 3           |
| 3                         | BO-303         | Medical pathology & Microbiology (General & Ocular) | 2        | 1         |   | 3  | 3           |
| 4                         | BO-304         | Pharmacology  | 2        | 1         |   | 3  | 3           |
| 5                         | BO-305         | Ophthalmic Instrumentation & Procedure -I           | 2        | 1         |   | 3  | 3           |
| <b>Total of Theory</b>    |                |   |          |           |   | 16 | 16          |
| C. PRACTICAL              |                |   |          |           |   |    |             |
| 1                         | BO-393         | Microbiology & Pathology                            |          |           | 2 | 2  | 2           |
| 2                         | BO-395         | Optical & Ophthalmic Instrumentation                |          |           | 4 | 4  | 4           |
| <b>Total of Practical</b> |                |   |          |           |   | 6  | 6           |
| <u>Total of Semester</u>  |                |   | 22       |           |   | 22 |             |

### FOURTH SEMESTER

| A. THEORY              |                |   |          |       |   |    |             |
|------------------------|----------------|---|----------|-------|---|----|-------------|
| SL.<br>No.             | CODE           | THEORY                                      | CONTACTS |       |   |    | CREDIT<br>S |
|                        | (PERIODS/WEEK) |   |          |       |   |    |             |
|                        | L              | T   | P        | TOTAL |   |    |             |
| 1                      | BO-401         | Introduction to Vision Science              | 2        | 1     |   | 3  | 3           |
| 2                      | BO-402         | Ocular Disease I (Anterior Segment Disease) | 3        | 1     |   | 4  | 4           |
| 3                      | BO-403         | Clinical Refraction I                       | 2        | 1     |   | 3  | 3           |
| 4                      | BO-404         | Ophthalmic Lens & Dispensing Optics         | 3        | 1     |   | 4  | 4           |
| 5                      | BO-405         | Ophthalmic Instrumentation & Procedure -II  | 2        | 1     |   | 3  | 3           |
| <b>Total of Theory</b> |                |   |          |       |   | 17 | 17          |
| B. PRACTICAL           |                |   |          |       |   |    |             |
| 1                      | BO-493         | Clinical Refraction-I                       |          |       | 3 | 3  | 3           |
| 3                      | BO-494         | Ophthalmic Lens & Dispensing Optics         |          |       | 3 | 3  | 3           |
| 3                      | BO-495         | Ophthalmic Instrumentation & Procedure      |          |       | 3 | 3  | 3           |

## Optometry Syllabus

|                          |    |    |
|--------------------------|----|----|
| Total of Practical       | 9  | 9  |
| <u>Total of Semester</u> | 26 | 26 |

### FIFTH SEMESTER

| A. THEORY                |        |  |                            |   |   |       |         |
|--------------------------|--------|--|----------------------------|---|---|-------|---------|
| SL<br>NO.                | CODE   | THEORY   | CONTACTS<br>(PERIODS/WEEK) |   |   |       | CREDITS |
|                          |        |  | L                          | T | P | TOTAL |         |
| 1                        | BO-501 | Low Vision Aids & Visual Rehabilitation              | 2                          | 1 |   | 3     | 3       |
| 2                        | BO-502 | Contact Lens   | 2                          | 1 |   | 3     | 3       |
| 3                        | BO-503 | Clinical Refraction II                               | 2                          | 1 |   | 3     | 3       |
| 4                        | BO-504 | Ocular Disease II<br>(Posterior & Neuro-eye Disease) | 3                          | 1 |   | 4     | 4       |
| 5                        | BO-505 | Public Health & Community Optometry                  | 2                          | 1 |   | 4     | 3       |
| Total of Theory          |        |  |                            |   |   | 16    | 16      |
| B. PRACTICAL             |        |  |                            |   |   |       |         |
| 1                        | BO-591 | Low Vision Aids & Visual Rehabilitation              |                            |   | 3 | 3     | 3       |
| 2                        | BO-592 | Contact Lens   |                            |   | 3 | 3     | 3       |
| 3                        | BO-593 | Clinical Refraction II                               |                            |   | 3 | 3     | 3       |
| Total of Practical       |        |  |                            |   |   | 9     | 9       |
| <u>Total of Semester</u> |        |  | 25                         |   |   | 25    |         |

### SIXTH SEMESTER

| A. THEORY |        |   |                            |   |   |       |         |
|-----------|--------|---|----------------------------|---|---|-------|---------|
| SL<br>NO. | CODE   | THEORY                                    | CONTACTS<br>(PERIODS/WEEK) |   |   |       | CREDITS |
|           |        |   | L                          | T | P | TOTAL |         |
| 1         | BO-601 | Systemic Condition & the eye              | 3                          | 1 |   | 4     | 4       |
| 3         | BO-602 | Fundamentals of Clinical Research methods | 2                          | 1 |   | 3     | 3       |
| 4         | BO-603 | Specialized Contact Lens                  | 2                          | 1 |   | 3     | 3       |
| 5         | BO-604 | Professional Practice Management          | 1                          | 1 |   | 2     | 2       |
| 6         | BO-605 | Applied Optometry & Orthoptics            | 2                          | 1 |   | 3     | 3       |

## B. Optometry Syllabus

|                          |        |                                |  |  |    |    |
|--------------------------|--------|--------------------------------|--|--|----|----|
| Total of Theory          |        |                                |  |  | 15 | 15 |
| B. PRACTICAL             |        |                                |  |  |    |    |
| 1                        | BO-694 | Contact Lens-II                |  |  | 4  | 4  |
| 2                        | BO-696 | Applied Optometry & Orthoptics |  |  | 4  | 4  |
| Total of Practical       |        |                                |  |  | 8  | 8  |
| <u>Total of Semester</u> |        |                                |  |  | 23 | 23 |

### Seventh Semester

| A. THEORY                |        |              |                            |   |   |       |         |
|--------------------------|--------|--------------|----------------------------|---|---|-------|---------|
| SL<br>NO.                | CODE   | THEORY       | CONTACTS<br>(PERIODS/WEEK) |   |   |       | CREDITS |
|                          |        |              | L                          | T | P | TOTAL |         |
|                          |        |              |                            |   |   |       |         |
| Total of Theory          |        |              |                            |   |   | 0     | 0       |
| SESSIONAL                |        |              |                            |   |   |       |         |
| 1                        | BO-781 | Project Work |                            |   |   |       | 6       |
| Total of Sessional       |        |              |                            |   |   | 0     | 6       |
| <u>Total of Semester</u> |        |              |                            |   |   | 0     | 6       |

Duration of the Project Work is Twenty Weeks

### Eighth Semester

| B. THEORY                |        |                         |                            |   |   |       |         |
|--------------------------|--------|-------------------------|----------------------------|---|---|-------|---------|
| SL<br>NO.                | CODE   | THEORY                  | CONTACTS<br>(PERIODS/WEEK) |   |   |       | CREDITS |
|                          |        |                         | L                          | T | P | TOTAL |         |
|                          |        |                         |                            |   |   |       |         |
| Total of Theory          |        |                         |                            |   |   | 0     | 0       |
| SESSIONAL                |        |                         |                            |   |   |       |         |
| 1                        | BO-881 | Internship              |                            |   |   |       | 6       |
| 2                        | BO-882 | Comprehensive Viva-Voce |                            |   |   |       | 6       |
| Total of Sessional       |        |                         |                            |   |   | 0     | 12      |
| <u>Total of Semester</u> |        |                         |                            |   |   | 0     | 12      |

Duration of the Internship is Twenty Weeks

## DETAILED SYLLABUS

### 1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER

#### GEOMETRICAL OPTICS-I

P.CODE: BO101

Contact: 3L+1T

Credits: 4

##### **Module:1**

- What is light- dual nature- particle & wave nature, speed, wave length & frequency of light.
- Fermats' principle- laws of relation & refraction at a plane surface using Fermats' principle.
- Snells' law, relative and absolute refractive indices, total internal reflection and Critical angle, refraction by plane parallel slab of glass.
- Geometrical path length & optical path length of rays, Concept of wave fronts & rays, concept of vergence- divergence, convergence.

##### **Module:2**

- Refraction by spherical surfaces- convex & concave, Derivation of vergence equation, focal points, deopree power, image point, lateral & axial magnification, simple numerical.
- Thin Lens- shapes, derivation of lens makers' formula, thin lens vergence equation, equivalent focal length of two thin lenses separated by a distance & placed in contact, lateral magnification of thin lenses in contact, simple numerical, concept of reduced systems.
- Thick Lens- Cardinal points & planes, front & back vertex power, matrix theory in paraxial Optics to locate positions of cardinal planes. Different types of aberrations & their effects.

##### **Module:3**

- Prism- Dispersion of prism, reflecting prisms , prisms diopters.
- Geometrical theory of optical fibers. Uses of optical fibers.
- Eye and Vision: Spectroradiometric curve-  $V_{\lambda}(\lambda)$ - $\lambda$  curve- photopic and scotopic vision CIE standard observes.

##### **Module:4**

- Photometric quantities and units- Luminous Flux, Lumen- Illuminance, lux Luminous intensity, Candela – Luminance, Candela/m<sup>2</sup>. Inverse square law and Cosine law of illumination (Illuminance)
- Calculation- Application of inverse square law and Cosine law- Matt surfaces.

##### **Reference books-**

1. *GEOMETRICAL OPTICS- R.S.LONGURST, OPTICS- E.HECHT*

### 1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER

#### PHYSIOLOGY (General)

P.CODE: BO102

Contact: 3L+1T

Credits: 4

##### **Module:1**

###### **1.Genetics**

- a. Nucleic acids-structure of DNA and RNA, their types, properties, replication of DNA, genetic code.
- b. Chromosomal aberration-structural and numerical aberration, gene mutation-definition and classification
- c. Application-genetics of colour blindness, ocular albinism, practical application of mutation.

###### **2.Blood vascular system**

Structures and functions of blood vessel types and their differences. Composition and functions of blood. Plasma proteins-types, origin, normal values,functions.Bone marrow-types and functions. Formed elements of blood-origin, formation,function,life span and fate,abnormalities of formed elements(both size and number)and related disease.Haemoglobin- structure , function and types of haemoglobin,abnormal

haemoglobin and related diseases. Blood coagulation-factors, process, anticoagulants, CT and BT. Blood groups-ABO system, Rh factors, blood transfusion and consequences of incompatible blood transfusion. Terminologies-TC, DC, ESR, PCV, MCV, MCH, MCHC, ESR and their significances.

## **Module: 2**

### **3. Cardio vascular system**

Structure and functions of heart. blood circulation types .special junctional tissues of heart and their importance. ECG. Cardiac cycle. Heart sounds. Cardiac output. blood pressure-definition, types, measurement method, significance of blood pressure measurement, controlling factors and regulation of blood pressure.

### **4. Renal system**

Structure and functions of kidney. Structure and functions of nephron. Formation of urine (filtration, reabsorption, secretion). Anomalies of urine concentration. Counter current system of urine concentration.

## **Module: 3**

### **5. Neuro-physiology**

Structure and functions of neuron /nerve cell. Neuroglia. Myelinated and unmyelinated nerve fibre with their conduction velocity. Properties of nerve fibre. synapse-structure, types, synaptic transmission, synaptic potential, neurotransmitter. ANS-Introduction, types, comparison of autonomic and somatic nervous system. NMJ-structure and events in transmission.

### **6. Muscular physiology**

Microscopic structure of skeletal, smooth and cardiac muscles and their differences. Properties of muscle. Red and white muscle. Single unit and multi unit smooth muscles. Motor point. Slow and fast muscle fibers. Isotonic and Isometric contractions. The Sarcotubular system. Muscle contraction-E.C. Coupling, Rigor mortis.

## **Module: 4**

### **7. Basic principles of Biology (Biophysical) and its application**

- a. Diffusion-definition, factors affecting diffusion, biomedical or biological application of diffusion, Fick's law of diffusion.
- b. Osmosis- definition, factors affecting osmosis, biomedical or biological application of osmosis, laws of osmosis.
- c. Acids, Bases, Ph-general overview
- d. Colloids-definition, classification, properties-optical and electrokinetics, biological application or significance of colloids.
- e. Chromatography- principles and application
- f. Electrophoresis-definition, principle, types and application
- g. Ultracentrifugation-definition, types
- h. Adsorption-Definition and types
- i. Gibb's – Donnan equilibrium
- j. Radioactivity-definition, biological application, radio isotopes, Radio-Immuno-Assay (RIA).
- k. Surface tension-definition, factors affecting surface tension, biomedical application of surface tension.
- l. Viscosity-definition, factors affecting viscosity, biomedical significance of viscosity.

### **Reference books:**

1. HUMAN PHYSIOLOGY: VOL 1 AND VOL 2-C.C.CHATTERJEE
2. PRINCIPLES OF ANATOMY AND PHYSIOLOGY- TORTORA,

## 1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER

### ANATOMY (General)

P.CODE: BO103

Contact: 3L+1T

Credits: 4

#### **Module:1**

##### Introduction of anatomy – gross human anatomy & their relations :

- The skeleton – axial & appendicular (over view), Cavities of body- (cranial, thoracic, abdominal, pelvic). Structure of bone, Type & function of bone, Blood & nerve supply of the bone. Planes of the body. Anatomical terminology.
- Skull – General features, Cranial bones (frontal, parietal, temporal, occipital, sphenoid, ethmoid). Facial bone – (nasal, maxilla, zygomatic, lacrimal, palatine, inferior nasal conchae, vomer, mandible). Special feature of the skull (sutures, paranasal sinuses, foramina, fontanelles, nasal septum).
- Joints – classification, fibrous joints, cartilaginous joints, synovial joints( structure & types). Types of movement at synovial joints.

#### **Module:2**

- Anatomy of muscular system – Skeletal muscle structure. Important skeletal muscle ( muscles of facial expression, mastication. Muscle that move the head). Over view of Trunk muscles, upper limb muscles, lower limb muscles.
- Anatomy of nervous system – spinal cord anatomy (external & internal anatomy). Connection & distribution of spinal nerves-overview( Branches, plexuses. Intercostal nerves). Overview of brain organization & blood supply. Brief anatomical idea on – brain stem, cerebellum, diencephalon, cerebrum. Cranial nerves.

#### **Module:3**

##### Embryology – general

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

#### **Module:4**

##### Cell Structure:

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

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

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

#### **Reference books:**

1. *PRINCIPLES OF ANATOMY AND PHYSIOLOGY- TORTORA,*
2. *ESSENTIALS OF ANATOMY & PHYSIOLOGY- MARTINI,*
3. *ESSENTIALS OF ANATOMY- I. SINGH*

### BIOCHEMISTRY

P.CODE: BO104

Contact: 1L+1T

Credits: 2

#### **Module:1**

**1.Carbohydrate and its metabolic pathways :** Definition, classification and functions of carbohydrate. Glycolysis, TCA cycle, Glycogenolysis, HMP shunt pathways with their significances

**Module:2**

**2. Amino acid, Protein and metabolic pathways :** Amino acid-definition, classification, function, properties. Protein-definition, classification and function. Primary, secondary, tertiary, quaternary structures of protein. Non protein nitrogen. Nitrogen balance. Transamination and deamination.

**3. Oxygen transporting protein:** Structure, types, compounds, derivatives and functions of haemoglobin. Myoglobin. Oxygen transporting mechanism of haemoglobin affinity for oxygen. Bohr's effect.

**Module:3**

**4.Lipid:** Definition, classification, function. Fatty acid-definition, classification, function  
Process of beta oxidation of unsaturated fatty acids. Overview of alpha and omega oxidation

**5. Enzymes :** General characteristics, classification of enzyme. Factors affecting enzyme activity. Kinetics of enzyme-k<sub>m</sub>, Michaelis-Menten equation, Line Weaver Burk Plot. Enzyme inhibition-Reversible and Irreversible. Allosteric enzyme.

**Module:4**

**6.Hormone :** Physical and chemical characteristics of hormone. types of hormone. general mechanism of hormone action. sources, functions and disorders for deficiency or excessive secretion(hypo/hyper secretions wherever applicable).

**Reference books:**

1. *BIOCHEMISTRY- DEBAJYOTI DAS, BIOCHEMISTRY-U.SATYANARAYAN AND U. CHAKRAPANI*

**1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER****PROFESSIONAL COMMUNICATION IN ENGLISH**

P.CODE: BO105

Contact: 1L+1T

Credits: 2

1. Grammar-structure of sentences etc.
2. Essay- Descriptive-Comparative-Argumentative etc.
3. Drafting of email & letter writing
4. Reading Comprehension from recommended text etc. biodata, Resume-curriculum vitae etc.
5. Report writing-structure, types of reports etc.

**Reference books:**

1. *COMMUNICATION (MARK MCCORMACK)*

2. *HOW TO WRITE REPORTS (JOHN METCHELL)*

3. *BUSINESS CORRESPONDENCE AND REPORT R.C. SHARMA & K.MOHAN (TATA MC GRAW, NEW DELHI 1984)*

**1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER****PRACTICAL SYLLABUS****GEOMETRICAL OPTICS-1**

P.CODE: BO-191

Contact: 4P

Credits: 4

1. Determination of the focal length & hence the power of a convex & Concave lens by displacement method.
2. Determination of the refractive index of a transparent liquid by using a travelling microscope.
3. Determination of the refractive index of the material of a convex lens measuring its focal length, using the lens & a plane mirror.



4. Determination of refractive index of the material of a prism by minimum deviation method.
5. To draw  $i-\delta$  curve of a prism by a spectrometer & hence to find out the angle of minimum deviation.
6. Calibrate the given physical photometer consisting of a photocell & a micrometer for at least five luminous intensities & three external circuit resistances. Use the calibrated photometer to determine C.P. of the given lamp.

1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER

PRACTICAL SYLLABUS

**PHYSIOLOGY (General)**

P.CODE: BO-192

Contact: 2P

Credits: 2

1. Identification of fixed histological slides – nerve tissues (cerebellum, cerebral cortex, neurons, spinal cord, nodes of Ranvier, corneal cell space), renal tissues. Blood vessels (artery & vein), skin, Tongue, Liver.
2. Identification of histological tissues: Epithelial tissue-squamous, columnar, cuboidal, Connective tissue-skeletal muscle, cardiac muscle, smooth muscle
3. Hemoglobin estimation
4. Determination of blood pressure
5. Determination of BT, CT, ESR
6. Blood film making & identification of different blood corpuscle.
7. ECG wave identification
8. Measurement of TC of RBC & WBC & DC of WBC.
9. Determination of Blood Group (ABO; Rh).

1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER

PRACTICAL SYLLABUS

**EFFECTIVE COMMUNICATION**

P.CODE: BO-195

Contact: 2P

Credits: 2

1. Communication-public speaking skills, features of effective speech etc.
2. Group discussions-principle-practice etc.

1<sup>st</sup> YEAR 2<sup>nd</sup> SEMESTER

**PHYSICAL OPTICS**

CODE: BO 201

Contact: 3L+1T

Credits: 4

**Module:1**

- HUYGENS' principle – laws of reflection and refraction at plane and spherical surfaces. Wave velocity & group velocity; determination of velocity of light (any one method.)
- Interference: Coherence; path and phase difference; Theory of interference fringes-intensity distribution in fringes; Young's double slit experiment- Fresnel's biprism, Lloyd's error experiments; visibility of fringes.
- Interference in thin films due to reflected and transmitted light- Interference in wedge shaped films; Newton's ring experiment; Color of thin films; Thin film antireflection coating and filters.

**Module:2**

- Diffraction: Diffraction by single slit; double slit, multiple slit- grating, circular aperture – amplitude & intensity distribution (final expressions only)
- Circular aperture- airy pattern, resolution by circular apertures.
- Diffraction grating- reflection, transmission, amplitude & phase gratings(definitions in brief) Grating

dispersion & dispersue power, spectral resolution; zone plates.

**Module:3**

- Polarization & Crystal Optics: Concept of polarization , polarizes, analyzers,
- Linear Scattering- Raleigh & Mce
- Principles of LASERs.

**Module:4**

- Lumen method of lighting design utilization factor, light loss factor,
- Glare and glare index- disability glare- discomfort glare- control of glare-
- Daylight, its properties.
- Color lamp – Incandescent .lamps - low pressure Hg-lamps- Low-pressure NA- lamp - Typical applications.
- Recommended level of illuminance for various including those in optometry and ophthalmology driving etc.
- VDU- Design of work station – Flicker color contrast- Regulations regarding the use of VDU.
- Eye Protectors- their constructions standard relating to eye protection

**Reference books-**

1. *OPTICS- E. HECHT*
2. *FUNDAMENTALS OF OPTICS- JENKINS*

1<sup>st</sup> YEAR 2<sup>nd</sup> SEMESTER

CODE-BO 202  
Contact: 3L+1T  
Credits: 4

**PHYSIOLOGY (Ocular)**

**Module:1**

1. Cornea:

Brief idea about ultra & histological structure of cornea. Corneal transparency & hydration, Regulation of corneal transparency & hydration. Corneal vascularization. Maurice theory & Goldman's theory. Biochemical composition of cornea. Sources of Nutrients-Oxygen, Glucose, Amino acid. Metabolic pathway in cornea – Glycolysis, HMP shunt.

2. Uveal tissue:

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

3. Lens:

Basic idea about human lens. Function of lens. Lens transparency. Lens culture. Changes in ageing lens. Biochemical composition of lens. Lens protein – their types & characteristics. Lens Metabolism - Carbohydrate metabolism, protein metabolism. Antioxidant mechanism in the lens.

4. Aqueous humour:

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

5. Vitreous Humour:

Composition & distribution of vitreous humour, Physiology & function of vitreous humour, Optical role of vitreous humour.

**Module:2**

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

7. Optic Nerve: Physiology of optic nerve. Photopigments – Rhodopsin & Iodopsin. Chemical nature of Rhodopsin. Visual cycle (Bleaching of Rhodopsin, Transducin cycle, Role of Phosphodiesterases).

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

Vitreous & blood aqueous barrier). Regulation of ocular circulation.

9. Protective Mechanism of the eye –

- a. Blinking – muscles of lid closer & lid opening (orbicularis oculi, levator palpebre, Muller's muscle, blinking reflexes).
- b. Lacrimation –
  - i) Lacrimal glands
  - ii) Pre corneal tear film
  - iii) Chemistry of lachrymal secretion tear film
  - iv) Tear film dynamics ( secretion of tear, formation of tear, retention & redistribution of tear, displacement phenomena, evaporation from tear film, drying & breakup of tear film, dynamic events during blinking, elimination of tear.)
  - v) Functions of Tear film. Different layers of Tear film. Chemical composition of tears. Tear film abnormalities. Tests for film Adequacy.

**Module:3**

10 . Intraocular pressure –

Features of normal IOP, Factors influencing the IOP,Control of IOP,Measurement of IOP.

11. Pupil – Normal pupil, Physiological changes in pupil size – Isocoria, Pupillary unrest, Hippies. Pupillary reflex – Light reflex, Near reflex, Darkness reflex , Psycho sensory reflex, Lid closure reflex.

12. Light & Dark adaptation – Dark adaptation curve, Mechanism of dark adaptation, Factors influencing dark adaptation, Time course of light adaptation, Mechanism of light adaptation, Rod vs. cone light adaptation. Purkinje shift of spectral sensitivity.

13. Accommodation –

- a. Far point , near point, range & amplitude of Accommodation
- b. Mechanism of accommodation – Increased tension theory, Relaxation theory, Role of lens capsule, Gullstrand mechanical model of accommodation,
- c. Stimulus for accommodation
- d. Ocular changes in accommodation.
- e. Changes in accommodation with age ( Presbyopia)
- f. Nervous mechanism for accommodation

**Module:4**

14. Visual acuity – visual angle, Components of Visual acuity ( Minimum visible, Resolution , Recognition Hyperacidity ), Factors affecting, Measurement of visual acuity.

15. Color vision-

- a. Physiological, Photochemical & neurological basis of color vision
- b. Electrophysiology of color vision
- c. Granit's modulator and dominator theory, Purkinje phenomenon. Young-Helmholtz theory
- d. Types of color defects
- e. Color blindness
- f. Neural analysis

**Module: 5**

16. Ocular Nutrition

- a. Vitamin & its Role in eye
- b. Role of Antioxidant
- c. Role of Omega 3 & 6 Fattyacid in eye care

**Reference books:**

*1.ANATOMY AND PHYSIOLOGY OF EYE- A.K.KHURANA, INDU KHURANA*

1st YEAR 2nd SEMESTER

CODE: BO 203  
Contact: 3L+1T  
Credits: 4

**ANATOMY (Ocular)**

**Module:1**

1. Embryology –ocular

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

2. Orbit

Bony orbit → Size, shape & relations, walls of the orbit, Base of the orbit, Apex of orbit.  
Orbital fascia → Fascial bulbi, Fascial sheaths of extraocular muscles, intermuscular septa.

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

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

**Module:2**

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

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

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

7. Retina & its vascular supply → (a). Gross anatomy, (b). Microscopic structure of fovea centralis, (c.) Anatomy of optic nerve, (d). Anatomy of optic nerve, (e.) optic chiasm, optic tracts, (f) Lateral Geniculate body, (g). optic radiation (h). visual cortex, (i). Arrangement of nerve fibers. (j). Blood supply of visual pathways (Arterial circle of Willis & its branches).

**Module:3**

8. The Ocular motor system → Extra ocular muscles, nerve supply, motor nuclei, supra nuclear motor centers.

9. The pupillary & ciliary muscle → Anatomy of sphincter & Dilator muscle. Ciliary muscle – Anatomy, types 12. The nerve supply of the eye ball.

10. The lacrimal apparatus → (a) Lacrimal gland, (b) Palpebral part, (c) Ducts of lacrimal gland, (d) structure of the lacrimal gland, (e) Blood supply & nerve supply of the lacrimal gland, (f) lacrimal passages.

**Module:4**

11. Anatomy of the Ocular Adnexa & glands; Lids - a. Structures of the lids: - Skin, Subcutaneous Areolar Layer, Layer of Striated muscle, Submuscular Areolar Tissue, Fibrous Layer, Conjunctiva. Glands of the Lids- Meibomian Glands, Glands of Zeiss and Glands of Moll. Blood Supply of the Lids, Lymphatic Drainage of the Lids, Nerve Supply of the Lids.

12. Conjunctiva - Palpebral Conjunctiva, Bulbar Conjunctiva, Conjunctival Fornix, Microscopic Structure of the conjunctiva- Epithelium, Substantia Propria. Conjunctival Glands → Krause's Glands, Wolfring's Glands, Henley's Glands, Manz Glands. Blood Supply of the Conjunctiva, Nerve Supply of the Conjunctiva, Caruncle, Plica Semilunaris.

**Reference books:**

1. *ANATOMY AND PHYSIOLOGY OF EYE- A.K.KHURANA, INDU KHURANA*

**ENVIRONMENT & ECOLOGY**

Paper Code: BO-204

Contact: 1L+1T

Credits: 2

**Module:1**

**General**

Introduction, components of the environment, environment degradation.

**Ecology**

Elements of Ecology; Ecological balance and consequences of change, principles of environmental impact assessment.

**Module:2**

**Air Pollution and Control**

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

**Water Pollution and Control**

Hydrosphere, natural water, pollutants: their origin and effects, river/lake/ground water pollution, standards and control.

**Module:3**

**Land Pollution**

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

**Noise Pollution**

Sources, effects, standards and control.

**Reference books:**

*1. ENVIRONMENT & ECOLOGY- SUNAKAR PANDA*

**COMPUTER FUNDAMENTALS**

Paper Code: BO-205

Contact: 1L+1T

Credits: 2

Basic computer Architecture:

Fundamentals of Computers, Block diagram of PC, peripheral devices of PC and their functions

Input/Output : Input Devices, Output devices

Processor and memory

Storage Devices

**Reference book:**

*1. COMPUTER FUNDAMENTALS BY SINHA AND SINHA*

## B.OPTM

1<sup>ST</sup> YEAR 2<sup>ND</sup> SEMESTER

PRACTICAL SYLLABUS

### PHYSICAL OPTICS-1

P.CODE: BO-291

Contact: 4P

Credits: 4

1. To determine the wavelength of a monochromatic light source with the help of Fresnel's Biprism.
2. To determine the radius of curvature of convex surface of a lens by Newton's ring method.
3. To determine Planck's constant using photocell.
4. To study the diffraction through a single slit & to determine its width.
5. To determine the slit width & the separation between the slits of a double slit system from its Fraunhofer diffraction pattern.
6. Determination of the wavelength of monochromatic light using diffraction grating.
7. To calibrate a Polarimeter & hence to determine the unknown concentration of sugar solution.
8. To determine the wavelength of the Laser source by forming diffraction pattern with transmission grating.
9. Use a calibrated Luxmeter to measure the levels of illumination at least 15 working places in the college. Identify the locations & note the measured levels at each location, indicating whether the measured values agree with the prescribed values for comfortable vision. If there are considerable deviations,

## B.OPTM

1<sup>ST</sup> YEAR 2<sup>ND</sup> SEMESTER

PRACTICAL SYLLABUS

P.CODE: BO-295

Contact: 2P

Credits: 2

### COMPUTER

- 1) Software and its type: Operating System (Windows 7/8/10) [Desktop elements, taskbar, Creation of folders and shortcuts, features of Windows Explorer]
- 2) Ms Word (2010/2013/2016)  
[Concept of Word Processor, Create document, Open document, Save document, Print document, Cut, Copy, Paste, Find and Replace, Basic formatting features- Paragraph alignment, indentation, line spacing, font styles, colours, size, Borders and Shading, Bullets and Numbering, Insert table, textbox, watermark, WordArt, margins, rulers, page break, section break, page orientation, spelling and grammar check, word count, comments, document views, headers and footers, clipart, cover page, format painter]
- 3) Ms Excel (2010/2013/2016)  
[Concept of Spreadsheet, workbook versus worksheet, range of cells, types of cell referencing, name box, formula bar, Autofill, conditional formatting, format as a table, Charts-column, bar and pie, Functions]
  - ✓ Autosum ( $\Sigma$ )
  - ✓ Text (LEFT, RIGHT, MID, LEN and TRIM)
  - ✓ Logical (AND,OR,NOT and IF)
  - ✓ Statistical( AVERAGE, COUNTIF, MEDIAN,MODE, MAX, MIN)
  - ✓ Date and Time (TODAY and NOW)
- 4) Ms PowerPoint (2010/2013/2016)  
[Concept of Presentation tool, Create a presentation , template, insert slide, change slide layout and format, custom animation, slide transition, slide master, delete slide, set up slide show]
- 5) Internet- Browser-set up home page, creating bookmark in browser, clearing history and browser cache, surfing,

Email- send mail, send attachment, Concept of Cloud Storage(Google drive)- [Save work in Google drive, create files and folders in Google drive, Sharing files in Google drive,]  
Rules for creating strong password and basic network security (Antivirus and firewall, protection from phishing mail)

2<sup>nd</sup> YEAR 1<sup>st</sup> SEMESTER

**VISUAL OPTICS (OPTICS III)**

Paper Code: BO-301

Contact: 3L+1T

Credits: 4

**Module:1**

- Schematic and reduced eyes and their properties.
- Optical constants of the eye and their measurement. Purkinje images. Corneal curvature and thickness. Indices of aqueous and vitreous.

**Module:2**

- Optical Defects of the Eye- Optical axis, Visual axis (angle alpha, Fixation axis (angle gamma), Aberration of the Optical system of eye, Depth of focus, Diffraction & resolving power.
- Emmetropia and ametropia, Axial versus spherical ametropia, Myopia Hypermetropia(Hyperopia) Astigmatism. Aphakia, Anisometria, Anisokonia, Genetical aspects of refractive error.

**Module:3**

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

**Reference Books:**

1. *PRINCIPLES & PRACTICE OF REFRACTION, DUKE ELDER*
2. *A TEXT BOOK OF VISUAL OPTICS – GOUTAM DUTTA*

2<sup>nd</sup> YEAR 1<sup>st</sup> SEMESTER

**BINOCULAR VISION & OCULAR MOTILITY**

Paper Code: BO-302

Contact: 2L+1T

Credits: 3

**Module:1**

Grades of binocular vision  
Retinal Correspondance

**Module:2**

Monocular clues  
Steropsis and its test

**Module:3**

Accommodation convergence and its anomalies  
Anisometropia and Anisokonia

**Module:4**

Binocular anomalies  
Ocular Movements

**Reference books:**

1. *ANATOMY AND PHYSIOLOGY OF EYE- A.K.KHURANA,INDU KHURANA*

**MICROBIOLOGY & PATHOLOGY (General & Ocular)**

Paper Code: BO-303

Contact: 2L+1T

Credits: 3

**Module:1**

**1. Bacteria**

Cell structure, classification of bacteria. Staining reactions—gram staining, spore staining, acid fast staining. Bacterial growth-nutritional requirement, physical factors affecting. Culture media, growth curve. Bactericidal agents- phenol, alcohol. Sterilization-principles, types, methods . Pasteurization. Antibiotics.

**2. Structure and functions of immune system**

Structure and functions of immune system. Structure and functions of thymus, spleen, red bone marrow.

**Module:2**

**3. Virus**

Elementary knowledge of viral morphology, viral genome and classification, viral replication, Herpes, Hepatitis and HIV virus.

**4. Immunity**

Immunity and its types. Cell mediated and humoral immunity-mechanism. Antigen and antibody. Theories of Ab formation. Specific and Non-specific immunity.

**5. Graft rejection**

**Module:3**

**6. Inflammation:** Types of inflammation. Changes associated with inflammation. Role of mast cell and platelet in inflammation

**7. Antimicrobial chemotherapy.** AIDS and related eye problem. BLEPHARITIS, KERATITIS, CONJUNCTIVITIS- brief overview

**8. Wound healing**-types, mechanism, factors regulating wound healing. Abnormalities in wound healing

**Module:4**

**9. Hypersensitivity**-Type I, II, III, IV

**10. Autoimmunity**-mechanism

**11. HLA system**

**12. Disorders of growth**-metaplasia, dysplasia, neoplasia

**13. Circulatory disturbance:** Thrombosis, infarction, ischaemia, embolism, calcification

**Module:5**

**Ocular Pathology:** Corneal scrapping, Conjunctival swab test

**Reference books:**

1. *A TEXT BOOK OF MICROBIOLOGY-P. CHAKRABORTY,*

2. *CONCISE PATHOLOGY- CHANDRASOMA,*

3. *A SHORT TEXT BOOK OF MEDICAL MICROBIOLOGY-SATISH GUPTE*



**PHARMACOLOGY (General & Ocular)**

Paper Code: BO-304

Contact: 2L+1T

Credits: 3

**Module:1**

General Pharmacology:

- Nature & Sources of drug. Routes of drug administration (general & Ocular). New drug delivery systems. Absorption & Bio availability of a drug. Distribution of a drug. Fate of a drug. Drug excretion & toxicity. Pharmacokinetics of drugs.
- Drug action → site of drug action, structure activity relationship. Drug receptor. Mechanism of action of a drug. Dose response relationship. Adverse drugs reactions (ADR) in man, Manifestations of ADR. Treatment of Acute drug poisoning. Factors influencing drug metabolism & drug action. Classification of drugs.

**Module:2**

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

**Module:3**

Ocular

- Ocular penetration & ophthalmic drug delivery system
- Topical anesthetics

**Module:4**

- Ophthalmic Drugs –  
Therapeutic: antibiotics, antiviral, antifungal, corticosteroids, viscoelastics agents. Antiglaucomic drugs, Ocular NSAIDS, Ocular lubricants, AntiVGF, Ocular antihistamine  
Diagnostics: Cyclopegic and mediatics, Ophthalmic Dyes.

**Reference books:**

1. *ESSENTIALS OF MEDICAL PHARMACOLOGY- K.D.TRIPATHY,*

2. *OCULAR THERAPEUTICS- ASHOK GARG*

**OPTICAL & OPHTHALMIC INSTRUMENTATION & PROCEDURE I**

Paper Code: BO-305

Contact: 2L+1T

Credits: 3

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

**Module:1**

- Telescopes: Optics & Dispensing
- Color Vision Test
- Radiuscope
- Retinoscopes

**Module:2**

- Standard Tests Charts: Visual Acuity, contrast sensitivity and projection chart
- Autorefractometer- subjective and objective types
- Ophthalmoscopes- direct and indirect types.

**Module:3**

- Slit lamp Biomicroscope
- Keratometer
- Lensometer

**Module:4**

- Trial case lenses-best forms.
- Trial frame design.
- Cross cylinder.

**Reference books-**

1. *THEORY AND PRACTICE OF OPTICS AND REFRACTION- A.K.KHURANA*

**2<sup>nd</sup> YEAR 1<sup>st</sup> SEMESTER****PRACTICAL SYLLABUS****MICROBIOLOGY & PATHOLOGY**

Paper Code: BO-393

Contact: 2P

Credits: 2

1. Gram Staining of bacteria
2. Slide Identification of nonvirulent bacteria's & pathogens.
3. Preparation of common stains used in microbiology & pathology ( Eosin Haematoxylin Leishmann Stain etc. )-(Demonstration).

**OPTICAL & OPHTHALMIC INSTRUMENTATION**

Paper Code: BO-395

Contact: 4P

Credits: 4

To study the operations of the following instruments:-

1. Lensometer.
2. Retinoscope.
3. Standard Test Charts.
4. Autorefractometer.
5. Slit Lamp Examination.
6. Keratometer.
7. Ophthalmoscope.

**2<sup>nd</sup> YEAR 2<sup>nd</sup> SEMESTER****INTRODUCTION TO VISION SCIENCE**

Paper Code: BO-401

Contact: 2L+1T

Credits: 3

**Module: 1**

Neurophysiology

1. Geniculate cortex:

- a. Structure of geniculate cortex.
- b. Electrophysiology
- c. Projection – retinal projection
- d. Detail idea about visual cortex & function of visual cortex.

2. Higher visual pathways(primary visual Pathway to cerebral center, Lateral Geniculate body, non-geniculate targets for retinofugal input, visual center)

**Module: 2**

3. Contrast Sensitivity – Types- (spatial & Temporal contrast sensitivity), Neural Mechanism, Measurement of contrast sensitivity ( Arden gratings , Cambridge low contrast gratings, Pelli – Robson chart)
4. Visual stimulus, photometry and spectral sensitivity.

**Module: 3**

5. Visual perception –Temporal and Spatial properties of visual function, Spatial analysis, Spatial vision, Spatial modulation thresholds, Double pathway to higher visual centers. Visual Discrimination, attention & cognition. Higher integrative activity, Binocular perception, stereoscopic depth perception.
6. Motion perception, perceptual organization and visual illusion.

**Module: 4**

7. Electrodiagnostic tests – ERG, EOG, VER
8. Visual psychophysics and its clinical application in measuring visual function
9. Vision Changes with age and disease
10. Newer developments in Vision science

**Reference Books**

1. *GOLDSTEIN E.B. SENSATION & PERCEPTION*
2. *PALMER S.E. : VISION SCIENCE: PHOTONS TO PHENOMENOLOGY*
3. *BRUCE, GREEN & GEORGESON : VISUAL PERCEPTION*
4. *SEKULER R. & BLAKE R.: PERCEPTION*
5. *MATHER G.: ESSENTIALS OF SENSATION AND PERCEPTION*

**2<sup>nd</sup> YEAR 2<sup>nd</sup> SEMESTER****OCULAR DISEASE -I (Anterior Segment Disease)**

Paper Code: BO- 402  
 Contact: 3L+1T  
 Credits: 4

**Module:1**

- Anterior segment ocular diseases involving orbit, eyelids, adnexa, conjunctiva, cornea, urea, sclera, anterior chamber, iris and lens. Symptomatology, clinical signs, diagnosis, pathogenesis, pathophysiology , systemic disease relationships and treatment of degenerative, infections and inflammatory conditions affecting these structures.
- Disease of the Lids –
- Diseases of the Lachrymal Apparatus-.
- Disease of the Conjunctiva

**Module:2**

- Disease of the Cornea
- Disease of the Sclera

**Module:3**

- Disease of the Iris
- Disease of the Ciliary Body

**Module:4**

- Glaucoma- Types and its Management (Basics Steps of Surgical Procedure)
- Disease of the Lens - its Management (Basics Steps of Surgical Procedure)

**Reference books:**

1. *CLINICAL OPHTHALMOLOGY- JACK J KANSKI*
2. *ESSENTIALS OF OPHTHALMOLOGY- SAMAR KUMAR BASAK*

CLINICAL REFRACTION -I

Paper Code: BO-403

Contact: 2L+1T

Credits: 3

**Module:1**

1. Ophthalmic Case Historian: Demographic data, chief complaints, secondary complaints, ocular history, medical history, drugs and medications, family ocular history, family medical history, social history, review of system, few example of history writing.
2. Objective Refraction: Streak Retinoscopy - all procedures to use streak retinoscope; static and dynamic retinoscopy, different methods of dynamic retinoscopy - MEM, Nott's, Sheard's, Low and high neutral, Bells, Cross, Taits. Other methods of retinoscopy-Radical, Near(Mahandra), Chromoretinoscopy, String Lensbar, use of objective and autorefractor.

**Module:2**

3. Subjective Refraction: Monocular Distance - Classic fogging, testing of astigmatism under fog fixed astigmatic dial (clock dial), rotary astigmatic dial, combination of fixed and rotary dial (Fan and Block test), J.C.C. Duochrome or Bichrome, Binocular balancing - alternate occlusion, prism dissociation, dissociated duochrome balance, Borish dissociated fogging, equalization
4. Binocular Distance - T.I.B. (Turville Infinity Balance), Polarized - Target and polarized filter, fogging.

**Module:3**

Near subjective refraction.

Cycloplegic refraction, cycloplegia, sudden unfogging , Borish delayed spherical end point, pinhole estimation of refractive error, stenopaic slit refraction, measurement of vertex distance, distometer, use of subjective autorefractor.

Different methods of measuring amplitude of accommodation.

**Module:4**

Correction of Presbyopia - Different methods of stimulation of tentative presbyopic addition - amplitude of accommodation, J.C.C., NRA-PRA balance, Bichrome, Plus Build-up, based on age, Dynamic retinoscopy. Occupational consideration, finalization of odd for near and intermediate-different options of correction.

Measurement of IPD and significance.

Final discussion with the patient.

Writing prescription of power and counseling

**Reference book: BORISH'S CLINICAL REFRACTION**

OPHTHALMIC LENS & DISPENSING OPTICS

Paper Code: BO-404

Contact: 2L+1T

Credits: 3

**Module:1**

Ophthalmic lens :

1.Characteristics of lenses:

Introduction. Spherical lenses. Plano-cylindrical lenses. Sphero-cylindrical lenses. Designation of lens

power. Power of lenses. Transposition. Base curve of spherical lens. Base curve of cylindrical single vision lens. Prism prescription and its application in dispensing.

2.Spectacle lenses:

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

3.Current materials:

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

### **Module:2**

4.Lens types:

Single vision lens. Bi-focal lenses. Tri-focal lenses. progressive lenses.

5.Ophthalmic lens coating:

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

6.Absorptive lenses:

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

### **Module:3**

7.Impact resistant lenses:

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

8.Lens for special uses:

Fresnel lenses. Thinline lenses. Lenticular Lenses. Aspheric lenses. Atoric Lens, Introduction to filter

9. Fundamentals of Lens surfacing & quality.

### **Module:4**

#### **Basics of dispensing:**

1. Spectacle frame : Types, Materials, Measurement & Selection

2. Lens Selection:

- a) Ground rule for selection
- b) Selection criteria

3. Facial Measurement & Measuring heights

### **Module:5**

4. Pediatric Dispensing & Management

5. Verification of trouble shooting of Lens & Frames

6. Occupational dispensing & its management

**Reference book:** *OPHTHALMIC ASSISTANT BY HAROLD A STEIN*

2<sup>nd</sup> YEAR 2<sup>nd</sup> SEMESTER

## **OPTICAL & OPHTHALMIC INSTRUMENTATION & PROCEDURE –II**

Paper Code: BO-405

Contact: 2L+1T

Credits: 3

### **Module:1**

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

- Tonometer – Principles, types, clinical importance as a routine procedure (application)
- Pachometer – Principles, types, clinical importance
- Ultrasonography – (A scan, B scan) – Principles and application. And basics of UBM

**Module:2**

- F.F.A – Principles and demonstration of film.
- PAM – Principles and importance.
- Perimeter – Basics of perimetry – Humphray instruments, Automated perimetry – basics, types(names) , interpretation of normal Glaucoma Field of Definition.

**Module:3**

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

**Module:4**

- Basics of OCT
- Basics of Phoropter
- Basics of Topography

**Reference book:**

1. *OPHTHALMIC ASSISTANT BY HAROLD A STEIN*
2. *CLINICAL OPHTHALMOLOGY- JACK J KANSKI*

Code: BO-493

Contacts: 3P

Credits: 3

**Clinical Refraction ( Practical )**

- History writing
- Recording VA
- Practice of Streak Retinoscopy
- Subjective refraction – fogging, clockdial, fan, JCC, prism balance, TIB, duochrome, cyclodeimia, Slit refraction
- Measurement of amplitude of accommodation.
- Presbyopic add
- Writing prescription.

Code: BO-494

Contacts: 3P

Credits:3

**Ophthalmic Lens & Dispensing Optics ( Practical )**

- a) Find out the menidean & optical center of ophthalmic lens
- b) Neutralization – manual
- c) Identification of lens-spherical, cylindrical & spheno-cylindrical lenses
- d) Marking of single vision, bifocal , progressive
- e) Frame measurement: The boxing system, the datum system. Comparison of the two systems, Lens position, segment specification
- f) Facial measurements: The PD, Visual axes, & measuring inter-pupillary distance using P.D ruler. Common difficulties in measuring P.D , Measuring monocular P.D, measuring near C.D.
- g) Measuring heights :- single vision , bifocal, multifocal, progressive
- h) Pediatric dispensing :- Frame selection & marking

Code: BO-495  
Contacts: 3P  
Credits:3

**Optics & Ophthalmic Instrumentation II (Practical)**

Clinical use of the following instruments & the findings:

- Tonometer
- Auto Perimeter-Normal HFA, printout
- A-scan:- Normal Print Out & analysis
- B-scan:- Normal Print Out & analysis
- OCT – Report Analysis
- Topography – Report Analysis

**3<sup>rd</sup> YEAR 1<sup>st</sup> SEMESTER**

**LOW VISION AID & VISUAL REHABILITATION**

Paper Code: BO-501  
Contact: 2L+1T  
Credits: 3

**Module:1**

- a) Definition-old, new, proposed
- b) Grades of low vision
- c) Epidemiology & Terminology of Low Vision

**Module: 2**

- d) Low vision optics-
  1. Magnification
  2. Optics of Galilian & Keplarian telescope- advantage/disadvantage, significance of exit & entrance pupil
  3. Optics of spectacle magnifier -Determination of add
  4. Optics of stand & hand magnifier
  5. Electronic magnifier

**Module: 3**

- e) Low vision examination: visual acuity, refraction, field testing, color vision, contrast sensitivity and glare testing
- f) Assessment & prescription of low vision devices-optical, non-optical & rehabilitation

**Module: 4**

- g) Overview of Rehabilitation Services
- h) Overview of systematic / retinal diseases in relation to low vision
- i) Counseling of low vision patient/ parents/ guardians/relatives

**Reference Books:**

1. *THE ART & PRACTICE OF LOW VISION , BY FREEMAN & JOSE, BUTTERWORT PUB.*
2. *UNDERSTANDING LOW VISION , AFB PUBLICATION*
3. *LOW VISION, BY FAYEA E.E.*
4. *LOW VISION PRACTICE- MONIKA CHOUDHURY*

**CONTACT LENS**

Paper Code: BO-502

Contact: 2L+1T

Credits: 3

**Module:1**

- a) Contact lens history & development. Benefits of contact lens over spectacle. Manufacturing methods-spin cast, Lethe cut, Cast modeling.
- b) Measurement of Contact lens
- c) Contact lens optics-Contact lens & spectacle lens. Back vertex calculation. Contact lens & Tear lens system.

**Module:2**

- d) Classification of contact lens & its material ( soft & RGP ); Material property.
- e) Contact lens terminology. RGP & soft lens design. FDA classification of contact lens material.
- f) Patient selection & prescreening. Indications & contra indications of contact lens.

**Module:3**

- g) Fitting & Assessment of soft contact lens & RGP.
- h) care & maintenance of Soft contact lens and RGP.
- i) Writing contact lens prescription and order.

**Module:4**

- j) Modification of finished RGP lens.
- k) Checking the parameters

**Reference book:**

1. *OPHTHALMIC ASSISTANT BY HAROLD A STEIN,*
2. *CONTACT LENS PRACTICE- MONIKA CHOUDHURY*

**CLINICAL REFRACTION - II**

Paper Code: BO-503

Contact: 2L+1T

Credits: 3

**Module:1**

- a) Assessment of children Vision & Paediatric evaluation, diagnosis & management.
- b) Aniblyopia.
- c) Neuro- Optometric Rehabilitation.

**Module:2**

- d) Evaluation, Diagnosis & Optometric management of special children
- e) Visual Disorders in senior citizens, evaluation, diagnosis & management.
- f) Sports vision.



**Module:3**

- g) Refraction in special cases
- h) Behavioral optometry
- i) Nystagmus and its optometric management

**Reference Books:**

1. *PAEDIATRIC OPTOMETRY, BY JEROME ROSNER*
2. *VISION DEVELOPMENT, BY ILG & BULLIS*
3. *MANAGEMENT OF SPECIAL POPULATION, BY DOMINIQUEE MAINO.*

3<sup>rd</sup> YEAR 1<sup>st</sup> SEMESTER**OCULAR DISEASE II**

(Posterior Segment &amp; Neuro-ophthalmic Disease)

Paper Code: BO-504

Contact: 3L+1T

Credits: 4

**Module:1**

- Diseases of the Vitreous Humor- Congenital Anomalies. Vitreous Opacities. Hereditary Vitreo – Retinal Degeneration's. Vitreous Haemorrhage .Detachment of Vitreous Humor . Vitreous Surgery .
- Methods of clinically assessing the posterior segment ( direct & indirect ophthalmoscopy)

**Module:2**

- Disease of the Retina- Congenital & Dev. Defects. Inflammation of the Retina(Retinitis) . Retinal Vasculitis . Oedema of the Retina. Haemorrhage of the Retina. Vascular Occlusion . Retinal Arteriosclerosis. Retinopathies . Retinal Telangiectasis. Degeneration's of the Retina. Detachment of the Retina. Surgical Procedures for Retinal Detachment .Tumours of the Retina. Phakomatoses,. Injuries of the Retina.
- Disease of the Optic Nerve- Congenital Anomalies. Papilloedema. Inflammation of the Optic Nerve(Optic-Neuritis). Ischaemic Optic Neuropathy . Optic Atrophy. Tumours of the Optic Nerve. Injuries of the Optic Nerve.

**Module:3**

- PUPILLARY REACTION
  - Abnormal pupillary reactions
    - ◆ Afferent pupillary conduction defects
    - ◆ Argyll robertson pupils
    - ◆ Differential dignosis of light-near dissociation
    - ◆ Adie pupil

**Module:4**

- Visual Pathway defects
- Migraine
- Myotonic dystrophy & blepharospasm
- NEUROFIBROMATOSIS- types and feature

**Reference books:**

1. *CLINICAL OPHTHALMOLOGY- JACK J KANSKI*

**PUBLIC HEALTH & COMMUNITY OPTOMETRY**

Paper Code: BO-505

Contact: 2L+1T

Credits: 3

**Module:1**

1. Concept of public health.
2. Principles of primary, secondary and tertiary care.
3. Planning of health services.

**Module:2**

4. Health Policies
5. Role of Optometrist in managing eye camps
6. NPCB and refractive blindness – optometrist’s role as primary health care provides.
7. Health cares insurance including role of TPA.

**Module:3**

8. Ocular emergencies –
  - a) Foreign body
  - b) Eye Pain
  - c) Watering
  - d) Injuries-perforating, non perforating & chemical
9. Role of International organization and NGOs in eye care

**Reference books:** *PREVENTIVE AND SOCIAL MEDICINE BY K.PARK*

**Low Vision Aids & Visual Rehabilitation ( Practical )**

Code: BO-591

Contacts: 3P

Credits: 3

- a) Case history.
- b) Assessment.
- c) Application of devices.
- d) Rehabilitation.

Code : BO-592

Contacts: 3P

Credits: 3

**Contact Lens ( Practical )**

- a) Routine clinical procedure for contact lens patient & selection of contact lens.
- b) Keratometry & slit lamp Biomicroscopy.
- c) Spherical soft & Spherical RGP contact lens fitting: selection of contact lens Base curve, diameter & Power & fitting Assessment .
- d) Insertion & Removal of soft & RGP contact lens.
- e) Contact lens & maintenance.

Code: BO-593

Contacts: 3P

Credits: 3

**Clinical Refraction –II ( Practical )**  
( Geriatric & Pediatric Optometry )

1. Assessment of children Vision & Paediatric evaluation, diagnosis & management.
2. Aniblyopia.
3. Evaluation, Diagnosis & Optometric management of special children
4. Refraction in special cases
5. Review of subjective refraction

3<sup>rd</sup> YEAR 2<sup>nd</sup> SEMESTER

**SYSTEMIC CONDITIONS & THE EYE**

Paper Code: BO-601

Contact: 3L+1T

Credits: 4

**Module:1**

1. Arterial Hypertension
  - i) Pathophysiology, classification, clinical examination, diagnosis, complications, management.
  - ii) Hypertension and the eye.
2. Diabetes mellitus
  - i) Pathophysiology, classification, clinical features, diagnosis, complications, management.
  - ii) Diabetes mellitus and the eye.
3. Malignancy
  - i) Definitions, nomenclature, characteristics of benign & malignant neoplasms.
  - ii) Grading and staging of cancer, diagnosis, principles of treatment.
  - iii) Neoplasia and the eye.

**Module:2**

4. Connective Tissue Disease
  - i) Anatomy and pathophysiology: Arthritis.
  - ii) Eye and connective tissue disease.
5. Thyroid Disease
  - i) Anatomy and physiology of the thyroid gland.
  - ii) Classification of thyroid disease
  - iii) Diagnosis, complications, clinical features, management of thyroid disease involving eye.

**Module:3**

6. Tuberculosis
  - i) Etiology, pathology, clinical features, pulmonary TB, diagnosis, complications, treatment of tuberculosis involving the eye.
7. Tropical Disease and the Eye
  - i) Leprosy.
  - ii) Syphilis.

**Module:4**

8. Genetic disorders and the eye.
9. Phacomatoses & the eye.

Reference books: CLINICAL OPHTHALMOLOGY- JACK J KANSKI

**FUNDAMENTALS OF CLINICAL RESEARCH**

Paper Code: BO-602

Contact: 2L+1T

Credits: 3

**Module:1**

1. Introduction to research
2. Types of research
3. Terminology
4. Steps involved in preparation of projects

**Module:2**

5. Research ethics
6. Introduction about Biostatistics, variables, data, population sample, parameter statistics, scales of measurement.
7. Classification & Presentation of data: Frequency distribution, Frequency polygon, Bar diagram, Histogram, Frequency distribution curve.
8. Descriptive statistics: Statistics of location, Mean Median Mode, Geometric mean, Range, Statistics of Dispersion, Mean Deviation, Standard Deviation, Coefficient of Variation. Correlation & Regression.

**Module:3**

9. Sampling Statistics: Sampling & Sampling Distribution, Sampling Errors & sampling statistics, Standard errors, Degree of freedom, Types of Sampling.
10. Probability Distribution: Classical definition, Conditional probability, Probability in continuous, Joint distribution of random variables.

**Module:4**

11. Experimental Design: Controlled and uncontrolled experiment, Sampling types, Sample size & pilot experiment, Single factor experiment & Factorial experiment-example, T-test.
12. Applications: Collection, presentation and analysis of hospital statistical data with examples. Collection, presentation and analysis of Optometric and ophthalmologic data with a few examples.
13. Case study

**Reference books:**

1. MANUAL OF BIOSTATISTICS & EPIDEMIOLOGY PRACTICALS- DR. N C LUWANG,  
BIOSTATISTICS- PRAVAKAR RAO

**SPECIALIZED CONTACT LENS**

Paper Code: BO-603

Contact: 2L+1T

Credits: 3

**Module:1**

1. Contact lens fitting in astigmatism.
2. Contact lens fitting in keratokonus.
3. Contact lens fitting in children.

**Module:2**

4. Cosmetic and prosthetic contact lenses.
5. Contact lens – Toric, Bifocal, Multifocal.
6. Therapeutic lenses / Bandage lenses.

**Module:3**

7. Recent advances in contact lenses.
8. Contact lens complications and their management.
9. Prosthetic eye fitting procedures & conformers.

**Reference book-** CONTACT LENS PRACTICE- MONIKA CHOUDHURY

3<sup>rd</sup> YEAR 2<sup>nd</sup> SEMESTER

**PROFESIONAL PRACTICE MANGEMENT**

Paper Code: BO-604

Contact: 1L+1T

Credits: 2

**Module:1**

1. Law & Optometry
  - Laws governing medical and paramedical professions
  - Consumer act with respect to optometry and dispensing of optical Aids.
  - International optometry.
  - Personal and professional insurance (indemnity).
  - Ethics.
  - Negligence.

**Module:2**

2. Basic Accountancy
  - Introduction.
  - Terms used in accounts, Principles of accountancy.
  - Journal & ledger
  - Trial Balance

**Module:3**

3. Public relations.
  - Definitions.
  - PR- its disfunction from publicity, propaganda & advertising.
  - Internal and external aspects of PR
  - Phases of PR: analysis building, promotion of product or services, better employee, government and community relation.

**Module:4**

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

3<sup>rd</sup> YEAR 2<sup>nd</sup> SEMESTER

**APPLIED OPTOMETRY AND ORTHOPTICS**

Paper Code: BO-605

Contact: 2L+1T

Credits: 3

**Module:1****1. ORTHOPTIC INSTRUMENTS**

- ◆ Prism Bar
- ◆ Synoptophore
- ◆ Maddox Wing

- ◆ Maddox Rod
- ◆ Red Green Goggles
- ◆ Hess Screen
- ◆ Risley Prisms

## Module:2

### 2. Investigative procedures

- ◆ Motor signs in squint
  - A) Head position: Face turn, chin position, Head tilt.
  - B) Cover test & cover-uncover tests
  - C) Maddox wing to assess heterophoria.
- ◆ Assessment of degree of squint
  - a) Hirschbag test.
  - b) Prism bar test.
  - c) Krimskey test
  - d) Synoptophore test

## Module:3

- ◆ Various Cranial nerve palsy – 3<sup>rd</sup>, 4<sup>th</sup> and 6<sup>th</sup>
- ◆ Assessment of ocular motility status
  - a) Hess chart
  - b) Diplopia testing
  - c) Bielschowskys Head tilting test
- ◆ Assessment of visual sensory status in squint.
  - Amblyopia
  - Suppression
  - Binocular single vision – SMP, Fusion, Stereopsis.
- ◆ Mechanisms leading to squint Types
  - of squint – a) latent / manifest
    - b) horizontal / vertical
    - c) paralytic / concomitant

## Module:4

### Orthoptic Treatment Procedures

Management of –

Convergence  
insufficiency Amblyopia  
Suppression ARC

Use of prism -

For Exercise & correction

Management of AMBLYOPIA

**Reference book: THEORY AND PRACTICE OF SQUINT AND ORTHOPTICS- A.K.KHURANA**

### ***SPECIALIZED CONTACT LENS***

BO-693

Contacts: 4P

Credits: 4

1. Fitting and assessment of contact lenses – steep, flat, optimum on spherical cornea.
2. Fitting and assessment of contact lenses – steep, flat, optimum on toric cornea with spherical lenses.
3. Fitting and assessment of contact lenses – steep, flat, optimum on toric cornea with toric lenses.
4. Teaching the patient to insert and remove contact lenses.
5. Writing Contact Lens prescriptions.

APPLIED OPTOMETRY AND ORTHOPTICS ( Practical )

BO 695

Contacts: 4P

Credits: 4

1. Demonstration of following Orthoptic instruments/methods and their uses – ♦ Prism Bar

- ♦ Synoptophore
- ♦ Maddox Wing
- ♦ Maddox Rod
- ♦ Red Green Goggles
- ♦ RAF Gauge
- ♦ Cover test
- ♦ Hirschberg test
- ♦ Krimsky test
- ♦ Diplopia charting
- ♦ Visuoscopy
- ♦ Accommodative flipper

2. Orthoptic Investigative & Therapeutic Procedure.

3. Case records.

| MOOCs for OPTOMETRY & Vision Science |  |   |            |         |  |
|--------------------------------------|--|---|------------|---------|--|
| SL NO                                | COURSE   | PROVIDER                                | DURATION   | CREDITS | NAME OF UNIVERSITY/ INSTITUTION                        |
| 1                                    | COMMUNICATION IN THE 21ST CENTURY WORKPLACE        | COURSERA                                | 4 WEEKS    | 1       | UNIVERSITY OF CALIFORNIA                               |
| 2                                    | PSYCHOLOGY AT WORK                                 | COURSERA                                | 6 WEEKS    | 2       | UNIVERSITY OF WESTERN AUSTRALIA                        |
| 3                                    | SOFT SKILL   | NPTEL                                   | 12 WEEKS   | 4       | IIT, KHARAGPUR   |
| 4                                    | ENVIRONMENTAL STUDIES- A GLOBAL PERSPECTIVE        | EDX                                     | SELF PACED | 4       | CURTIN UNIVERSITY                                      |
| 5                                    | SPEAKING EFFECTIVELY                               | NPTEL                                   | 8 WEEKS    | 3       | IIT, KHARAGPUR   |
| 6                                    | THE SCIENCE OF EVERYDAY THINKING                   | EDX                                     | 12 WEEKS   | 4       | UNIVERSITY OF QUEENSLAND                               |
| 7                                    | ETHICS   | EDX                                     | 7 WEEKS    | 2       | DELFTX   |
| 8                                    | Presentation Skills: Designing Presentation Slides | Coursera                                | 4 weeks    | 1       | Tomsk State University                                 |
| 9                                    | Working in Teams: A Practical Guide                | edX                                     | 4 weeks    | 1       | University of Queensland                               |
| 10                                   | Write Professional Emails in English               | Coursera                                | 5 weeks    | 2       | Georgia Institute of Technology                        |
| 11                                   | Developing Soft Skills and Personality             | NPTEL                                   | 8 WEEKS    | 3       | IIT, KHARAGPUR   |
| 12                                   | Anatomy, Physiology, and Pathology of the Eye      | J. Sargeant Reynolds Community College  | 3 Hrs/Week | 3       | Virginia's Community college                           |
| 13                                   | Introduction to Clinical Neurology                 | COURSERA                                | 6 WEEKS    | 2       | University of California                               |
| 14                                   | General Pathophysiology                            | Coursera                                | 6 WEEKS    | 2       | Saint Petersburg State University                      |
| 15                                   | Visual Perception and the Brain                    | Coursera                                | 5 weeks    | 2       | Duke University  |
| 16                                   | OPTOMETRY CME                                      |   |            |         | WORLD COUNCIL OF OPTOMETRY                             |
| 17                                   | DLP FOR OPTICAL SALES PERSONNEL                    | ESSILOR                                 | 9 MONTHS   | 6       | SANKAR NETRALAYA                                       |
| 18                                   | Vision Science                                     | Scott Stevensons                        | 4 Months   | 4       | University of Houston                                  |
| 19                                   | ESSILOR ACADEMY                                    | ESSILOR                                 | 3 DAYS     | 1       | SANKAR NETRALAYA                                       |
| 20                                   | CONTACT LENS EDUCATION ONLINE                      |   |            |         | THE JOHNSON & JOHNSON INSTITUTE                        |
| 21                                   | MMIC   | BAUSCH & LOMB                           | 3 MONTHS   | 3       | IACLE  |
| 22                                   | ONLINE CONTINUING EDUCATION IN OPTOMETRY           | NEW ENGLAND COLLEGE OF OPTOMETRY        |            | 2       | New England Eye Institute network of eye care centers. |
| 23                                   | ONLINE CONTINUING EDUCATION IN OPTOMETRY           | PACIFIC UNIVERSITY COLLEGE OF OPTOMETRY |            | 2       | PACIFIC UNIVERSITY                                     |
| 24                                   | ONLINE CONTINUING EDUCATION IN OPTOMETRY           | CALIFORNIA OPTOMETRIC ASSOCIATION       |            | 2       | CALIFORNIA OPTOMETRIC ASSOCIATION                      |
| 25                                   | ONLINE CONTINUING EDUCATION IN OPTOMETRY           | NSU COLLEGE OF OPTOMETRY                |            | 2       | NOVA SOUTH EASTERN UNIVERSITY                          |



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|----|--|--|--------|---|---|
| 26 | CONTINUING PROFESSIONAL EDUCATION            | SUNY COLLEGE OF OPTOMETRY                |        | 2 | STATE UNIVERSITY OF NEW YORK  |
| 27 | ONLINE CONTINUING EDUCATION IN OPTOMETRY     | OKLAHOMA COLLEGE OF OPTOMETRY            |        | 2 | NSUOCO  |
| 28 | ONLINE CONTINUING EDUCATION IN OPTOMETRY     | BERKELEY SCHOOL OF OPTOMETRY             |        | 2 | UNIVERSITY OF CALIFORNIA  |
| 29 | ONLINE CONTINUING EDUCATION IN OPTOMETRY     | SOUTHERN CALIFORNIA COLLEGE OF OPTOMETRY |        | 2 | MARSHALL B KETCHUM UNIVERSITY   |
| 30 | ONLINE CONTINUING EDUCATION IN OPTOMETRY     | REVIEW OF OPTOMETRY                      |        | 2 | REVIEW OF OPTOMETRY APPROVED BY The Council on Optometric Practitioner Education (COPE) |
| 31 | ONLINE CONTINUING EDUCATION IN OPTOMETRY     | COMMUNITY FOR VISION                     |        | 2 | COMMUNITY FOR VISION APPROVED BY COPE   |
| 32 | ONLINE CONTINUING EDUCATION IN OPTOMETRY     | AMERICAN OPTOMETRIC ASSOCIATION          |        | 2 | AOA ( ONLY FOR AOA MEMBERS)   |
| 33 | ADVANCED COURSE IN LOW VISION REHABILITATION |  | 40 HRS | 3 | GERMAN JORDANIAN UNIVERSITY   |