

**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB**  
(Formerly West Bengal University of Technology)

**Syllabus for Bachelors in Optometry Programme**  
(Effective for Students Admitted in Academic Session 2021-2022)

**CURRICULUM STRUCTURE**

**1<sup>ST</sup> YEAR**

SL No	CODE	Paper	Contact Periods per week			Total Contact Hours	Credits
			L	T	P		
<b>SEMESTER I</b>							
<b>Theory</b>							
1	BO-101	Geometrical Optics (Optics I)	3	0		3	3
2	BO-102	Physiology (General)	3	1		4	4
3	BO-103	Anatomy (General)	3	0		3	3
4	BO-104	Basics of Biochemistry	1	1		2	2
5	BO-105	Professional communication in English	1	1		2	2
<b>Practical</b>							
1	BO-191	Geometrical Optics (Optics I)	0	0	2	2	2
2	BO-192	Physiology (General)	0	0	2	2	2
3	BO-193	Professional communication in English	0	0	2	2	2
<b>Total</b>			<b>20</b>				
<b>SEMESTER II</b>							
<b>Theory</b>							
1	BO-201	Physical Optics (Optics II)	3	1	0	4	4
2	BO-202	Ocular Physiology & Nutrition	3	1	0	4	4
3	BO-203	Anatomy (Ocular)	2	1	0	3	3
4	BO-204	Environment & Ecology	1	1	0	2	2
5	BO-205	Computer Fundamentals	1	1	0	2	2
<b>Practical</b>							
1	BO-291	Physical Optics (Optics II)	0	0	3	3	3
2	BO-292	Computer Fundamentals	0	0	2	2	2
<b>Total</b>			<b>20</b>				

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**2<sup>ND</sup> YEAR**

SL No	CODE	Paper	Contact Periods per week			Total Contact Hours	Credits
			L	T	P		
<b>SEMESTER III</b>							
<b>Theory</b>							
1	BO-301	Visual Optics	3	0	0	3	3
2	BO-302	Binocular Vision & Ocular motility	2	1	0	3	3
3	BO-303	Medical pathology & Microbiology (general and ocular)	2	1	0	3	3
4	BO-304	Pharmacology	2	1	0	3	3
5	BO-305	Ophthalmic Instrumentation and procedure-I	2	1	0	3	3
<b>Practical</b>							
1	BO-391	Medical pathology & Microbiology (general and ocular)	0	0	2	2	2
2	BO-392	Ophthalmic Instrumentation and procedure-I	0	0	3	3	3
<b>Total</b>			<b>20</b>				
<b>SEMESTER IV</b>							
<b>Theory</b>							
1	BO-401	Introduction to Vision Science	2	0	0	2	2
2	BO-402	Ocular Disease-I (Anterior Segment Disease)	2	1	0	3	3
3	BO-403	Clinical refraction I	2	1	0	3	3
4	BO-404	Ophthalmic Lens & Dispensing optics	2	1	0	3	3
5	BO-405	Ophthalmic Instrumentation & procedure-II	2	1	0	3	3
<b>Practical</b>							
1	BO-491	Clinical refraction I	0	0	2	2	2
2	BO-492	Ophthalmic Lens & Dispensing optics	0	0	2	2	2
3	BO-493	Ophthalmic Instrumentation & procedure-II	0	0	2	2	2
<b>Total</b>			<b>20</b>				

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**3<sup>RD</sup> YEAR**

SL No	CODE	Paper	Contact Periods per week			Total Contact Hours	Credits
			L	T	P		
<b>SEMESTER V</b>							
<b>Theory</b>							
1	BO-501	Low Vision Aids & Visual Rehabilitation	2	1	0	3	3
2	BO-502	Contact Lens	2	1	0	3	3
3	BO-503	Clinical Refraction II	2	1	0	3	3
4	BO-504	Ocular Disease II (Posterior and Neuro eye disease)	3	0	0	3	3
5	BO-505	Public Health and Community optometry	2	0	0	2	2
<b>Practical</b>							
1	BO-591	Low vision Aid and Visual Rehabilitation		0	2	2	2
2	BO-592	Contact Lens		0	2	2	2
3	BO-593	Clinical Refraction II		0	2	2	2
<b>Total</b>			<b>20</b>				
<b>SEMESTER VI</b>							
<b>Theory</b>							
1	BO-601	Systemic Condition & the eye	3	0	0	3	3
2	BO-602	Fundamentals of Clinical Research methods	2	1	0	3	3
3	BO-603	Specialized Contact lens	2	1	0	3	3
4	BO-604	Professional Practice Management	2	0	0	2	2
5	BO-605	Applied optometry and Orthoptics	2	1	0	3	3
<b>Practical</b>							
1	BO-693	Specialized Contact lens		0	3	3	3
2	BO-695	Applied optometry and Orthoptics		0	3	3	3
<b>Total</b>			<b>20</b>				

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<b>Semester – VII</b>							
<b>Practical</b>							
1	BO-781	INTERNSHIP-I			10		
2	BO-782	PROJECT (INTERIM)			10		
<b>Total</b>					<b>20</b>		
<b>Semester – VIII</b>							
<b>Practical</b>							
1	BO-881	INTERNSHIP-II			10		
2	BO-882	COMPREHENSIVE VIVA VOICE & PROJECT(FINAL)			10		
<b>Total</b>					<b>20</b>		

Honours degree requirements: Additional 16 credits from MOOCS of the MOOCS basket

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**Detailed Syllabus**

**SEMESTER-I**

**Paper: GEOMETRICAL OPTICS**

**Code: BO-101**

**Contacts Hours / Week: 3L+0T**

**Credits: 3**

<b>Course Content</b>	
<b>Unit/ Module 1</b>	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
<b>Unit/ Module 2</b>	<ul style="list-style-type: none"><li>• Refraction by spherical surfaces- convex &amp; concave, Derivation of vergence equation, focal points, deportee power, image point, lateral &amp; axial magnification, simple numerical.</li><li>• Thin Lens- shapes, derivation of lens makers' formula, thin lens vergece equation, equivalent focal length of two thin lenses separated by a distance &amp; placed in contact, lateral magnification of thin lenses in contact, simple numerical, concept of reduced systems.</li><li>• Thick Lens- Cardinal points &amp; planes, front &amp; back vertex power. Different types of aberrations &amp; their effects.</li></ul>
<b>Unit/ Module 3</b>	<ul style="list-style-type: none"><li>• Prism- Dispersion of prism, reflecting prisms , prisms diopters.</li><li>• Geometrical theory of optical fibers. Uses of optical fibers.</li><li>• Eye and Vision: Spectroradiometric curve- <math>V_{\lambda}</math> -<math>\lambda</math> curve- photopic and scotopic vision CIE standard observes.</li></ul>
<b>Unit/ Module 4</b>	<ul style="list-style-type: none"><li>• Photometric quantities and units- Luminous Flux, Lumen- Illuminance, lux Luminous intensity, Candela</li><li>• Luminance, Candela/m<sup>2</sup>. Inverse square law and Cosine law of illumination (Illuminance)</li></ul>

**Suggested Readings:**

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

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**Paper: Physiology (General)**

**Code: BO-102**

**Contacts Hours / Week: 3L+1T**

**Credits: 4**

<b>Course Content</b>	
<b>Unit/ Module 1</b>	<p><b>1.Genetics</b></p> <p>a. Nucleic acids-structure of DNA and RNA, their types, properties, replication of DNA, genetic code.</p> <p>b. Chromosomal aberration-structural and numerical aberration, gene mutation-definition and classification c. Application-genetics of colour blindness, ocular albinism, practical application of mutation.</p> <p><b>2.Blood vascular system</b></p> <p>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.</p>
<b>Unit/ Module 2</b>	<p><b>3.Cardio vascular system</b></p> <p>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.</p> <p><b>4.Renal system</b></p> <p>Structure and functions of kidney. Structure and functions of nephron. Formation of urine(filtration, reabsorption,secretion).Anomalies of urine concentraiaon.Counter current system of urine concentration.</p>
<b>Unit/ Module 3</b>	<p><b>5.Neuro-physiology</b></p> <p>Structure and functions of neuron /nerve cell. Neuroglia. Myelinated and unmyelinated nerve fibre with their conduction velocity.Properties of nerve</p>

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	<p>fibre.synapse-structure,types,synaptictransmission,synaptic potential, neurotransmitter. ANS- Introduction, types, comparison of autonomic and somatic nervous system. NMJ-structure and events in transmission.</p> <p><b>6.Muscular physiology</b></p> <p>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.</p>
<b>Unit/ Module 4</b>	<p><b>7.Basic principles of Biology(Biophysical)and its application</b></p> <p>a. Diffusion-definition, factors affecting diffusion, biomedical or biological application of diffusion, Fick’s law of diffusion.</p> <p>b. Osmosis- definition, factors affecting osmosis, biomedical or biological application of osmosis, laws of osmosis.</p> <p>c - Acids, Bases, Ph-general overview</p> <p><b>d. Basic idea on Digestion and absorption of food</b></p> <p><b>e. Basic idea on respiratory system</b></p>

**Reference books:**

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

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**Paper: Anatomy (General)**

**CODE: BO103**

**Contact: 3L+0T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<p><u>Introduction of anatomy – gross human anatomy &amp; their relations :</u></p> <ul style="list-style-type: none"> <li>• The skeleton – axial &amp; appendicular (over view), Cavities of body- (cranial, thoracic, abdominal, pelvic). Structure of bone, Type &amp; function of bone, Blood &amp; nerve supply of the bone. Planes of the body. Anatomical terminology.</li> <li>• 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).</li> <li>• Joints – classification, fibrous joints, cartilaginous joints, synovial joints (structure &amp; types). Types of movement at synovial joints.</li> </ul>
<b>UNIT/MODULE 2</b>	<p>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.</p> <p>Anatomy of nervous system – spinal cord anatomy (external &amp; internal anatomy). Connection &amp; distribution of spinal nerves-overview( Branches, plexuses. Intercostal nerves). Overview of brain organization &amp; blood supply. Brief anatomical idea on – brain stem, cerebellum, diencephalon, cerebrum. Cranial nerves.</p>
<b>UNIT/MODULE 3</b>	<p><u>Embryology – general</u></p> <p>Gametogenesis(spermatogenesis &amp; oogenesis) –Structure of testis, ovary &amp; sperm –Phases of embryonic development – formation of three germ layers- derivatives of germ layers –Embryonic or Foetal membrane (chorion, amnion, allantois, yolk sac) &amp; placenta &amp; its functions</p>
<b>UNIT/MODULE 4</b>	<p><u>Cell Structure:</u> Ultra structure and functions of cell - Plasma membrane- Nucleus – Mitochondria- Centrosome-Ribosome -Endoplasmic reticulum- Golgi body &amp; lysosome. Nucleus – Ultra structure &amp; functions.</p> <p><u>Cell Division:</u> Amitosis- Mitosis- Meiosis- Significance of mitosis &amp; meiosis- Cell cycle.</p> <p><u>Tissues:-</u> Structure, position and functions of epithelial, connective, muscular &amp; nervous tissue.</p>

**Reference books:**

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



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**Paper: Basics of Biochemistry**

**CODE: BO104**

**Contact: 1L+1T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<b>1. Carbohydrate and its metabolic pathways</b> :Definition, classification and functions of carbohydrate. Glycolysis, TCA cycle, Glycogenolysis, HMP shunt pathways with their significances
<b>UNIT/MODULE 2</b>	<b>2. Amino acid, Protein and metabolic pathways</b> :Amino acid- definition, classification, function, properties. Protein-definition, classification and function. Primary, secondary, tertiary, quaternary structures of protein. Non protein nitrogen. Nitrogen balance. Trans-amination and deamination. <b>3. Oxygen transporting protein:</b> Structure, types, compounds, derivatives and functions of haemoglobin. Myoglobin. Oxygen transporting mechanism of haemoglobin affinity for oxygen. Bohr's effect.
<b>UNIT/MODULE 3</b>	<b>4. Vitamins and antioxidants</b>  <b>5. Enzymes:</b> 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.
<b>UNIT/MODULE 4</b>	<b>6. Hormone:</b> 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**

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**Paper: PROFESSIONAL COMMUNICATION IN ENGLISH**

**CODE: BO105**

**Contact: 1L+1T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	Grammar-structure of sentences etc. Essay- Descriptive-Comparative-Argumentative etc.
<b>UNIT/MODULE 2</b>	Drafting of email & letter writing Report writing-structure, types of reports etc.
<b>UNIT/MODULE 3</b>	Reading comprehension from recommended text
<b>UNIT/MODULE 4</b>	Biodata, Resume-curriculum vitae 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)*

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**PRACTICAL SYLLABUS**

**PAPER: GEOMETRICAL OPTICS-1**

**P.CODE: BO-191**

**Contact: 2P**

**Credits: 2**

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.

**Paper: PHYSIOLOGY (General)**

**P.CODE: BO-192**

**Contact: 2P**

**Credits: 2**

1. Identification of histological tissues: Epithelial tissue-squamous, columnar, cuboidal, Connective tissue-skeletal muscle, cardiac muscle, smooth muscle
  2. Hemoglobin estimation
  3. Determination of blood pressure
4. Determination of BT, CT, ESR
  5. Blood film making & identification of different blood corpuscle.
  6. Measurement of TC of RBC & WBC & DC of WBC.
  7. Determination of Blood Group (ABO; Rh).

**Paper: EFFECTIVE COMMUNICATION**

**P.CODE: BO-193**

**Contact: 2P**

**Credits: 2**

1. Communication-public speaking skills, features of effective speech etc.
2. Group discussions-principle-practice etc.
3. Effective Communication skills, Kul Bhushan Kumar, Khanna Publishing House

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**2<sup>nd</sup> SEMESTER**

**Paper: PHYSICAL OPTICS**

**CODE: BO 201**

**Contact: 3L+1T**

**Credits: 4**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> HUYGENS' principle – laws of reflection and refraction at plane and spherical surfaces. Wave velocity &amp; group velocity; determination of velocity of light (any one method.)</li> <li><input type="checkbox"/> Interference: Coherence; path and phase difference; Theory of interference fringes-intensity distribution in fringes; Young's double slit experiment- Fresnel's bi-prism, Lloyd's error experiments; visibility of fringes.</li> <li><input type="checkbox"/> Interference in thin films due to reflected and transmuted light- Interference in wedge shaped films; Newton's ring experiment; Colour of thin films; Thin film antireflection coating and filters.</li> </ul>
<b>UNIT/MODULE 2</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <u>Diffraction</u>: Diffraction by single slit; double slit, multiple slit-grating, circular aperture – amplitude &amp; intensity distribution (final expressions only)</li> <li><input type="checkbox"/> Circular aperture- airy pattern, resolution by circular apertures.</li> </ul> <p>Diffraction grating- reflection, transmission, amplitude &amp; phase gratings (definitions in brief) Grating dispersion &amp; dispersive power, spectral resolution; zone plates.</p>
<b>UNIT/MODULE 3</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <u>Polarization &amp; Crystal Optics</u>: Concept of polarization, polarizers, analyzers,</li> <li><input type="checkbox"/> Linear Scattering- Rayleigh &amp; Mie</li> <li><input type="checkbox"/> Principles of LASERS.</li> </ul>
<b>UNIT/MODULE 4</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Lumen method of lighting design utilization factor, light loss factor,</li> <li><input type="checkbox"/> Glare and glare index- disability glare- discomfort glare- control of glare-</li> <li><input type="checkbox"/> Daylight, its properties.</li> <li><input type="checkbox"/> Color lamp – Incandescent lamps - low pressure Hg-lamps- Low-pressure NA- lamp - Typical applications.</li> <li><input type="checkbox"/> Recommended level of illuminance for various including those in optometry and ophthalmology driving etc.</li> <li><input type="checkbox"/> VDU- Design of work station – Flicker color contrast- Regulations regarding the use of VDU.</li> <li><input type="checkbox"/> Eye Protectors- their constructions standard relating to eye protection</li> </ul>

**Reference books-**

1. OPTICS- E. HECHT

2. FUNDAMENTALS OF OPTICS- JENKINS

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**Paper: OCULAR PHYSIOLOGY**

**CODE-BO 202**

**Contact: 3L+1T**

**Credits: 4**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<p>1. Cornea: Brief idea about ultra &amp; histological structure of cornea. Corneal transparency &amp; hydration, Regulation of corneal transparency &amp; hydration. Corneal vascularization. Maurice theory &amp; Goldman's theory. Biochemical composition of cornea. Sources of Nutrients- Oxygen, Glucose, Amino acid. Metabolic pathway in cornea – Glycolysis, HMP shunt.</p> <p>2. Uveal tissue: Brief idea about uvea. Uveal meshwork. Uveo-scleral drainage. Schlemm's canal switch.</p> <p>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 &amp; characteristics. Lens Metabolism - Carbohydrate metabolism, protein metabolism. Antioxidant mechanism in the lens.</p> <p>4. Aqueous humour: Formation of Aqueous humour. Drainage &amp; circulation of Aqueous Humor. Rates of production &amp; flow. Functions of Aqueous humour.</p> <p>5. Vitreous Humour: Composition &amp; distribution of vitreous humour, Physiology &amp; function of vitreous humour, Optical role of vitreous humour.</p>
<b>UNIT/MODULE 2</b>	<p>6. Retina: Retinal structure-layers of retina. Brief idea about rod &amp; cones. Organization of retina. Function of retina.</p> <p>7. Optic Nerve: Physiology of optic nerve. Photopigments – Rhodopsin &amp; Iodopsin. Chemical nature of Rhodopsin. Visual cycle (Bleaching of Rhodopsin, Transducin cycle, Role of Phosphodiesterases).</p> <p>8. Ocular Circulation : Vascular structure of the eye – ocular circulation, blood-ocular barrier (Blood-retinal, blood Vitreous &amp; blood aqueous barrier). Regulation of ocular circulation.</p>

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	<p>9. Protective Mechanism of the eye –</p> <ul style="list-style-type: none"><li>a. Blinking – muscles of lead closer &amp; lid opening (orbicularisocculi, levatorpalpebre, Muller’s muscle, blinking reflexes.</li><li>b. Lacrimation –<ul style="list-style-type: none"><li>i) Lacrimal glands</li><li>ii) Pre corneal tear film</li><li>iii) Chemistry of lachrymal secretion tear film</li><li>iv) Tear film dynamics ( secretion of tear, formation of tear, retention &amp; redistribution of tear, displacement phenomena, evaporation from tear film, drying &amp; breakup of tear film, dynamic events during blinking, elimination of tear.)</li><li>v) Functions of Tear film. Different layers of Tear film. Chemical composition of tears. Tear film abnormalities. Tests for film Adequacy.</li></ul></li></ul>
<p><b>UNIT/MODULE 3</b></p>	<p>10 . Intraocular pressure – Features of normal IOP, Factors influencing the IOP,Control of IOP,Measurement of IOP.</p> <p>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.</p> <p>12.Light &amp; 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.</p> <p>13.Accommodation –</p> <ul style="list-style-type: none"><li>a. Far point , near point, range &amp; amplitude of Accommodation</li><li>b. Mechanism of accommodation – Increased tension theory, Relaxation theory, Role of lens capsule, Gullstrand mechanical model of accommodation,</li><li>c. Stimulus for accommodation</li><li>d. Ocular changes in accommodation.</li><li>e. Changes in accommodation with arc ( Presbyopia)</li><li>f. Nervous mechanism for accommodation</li></ul>

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<b>UNIT/MODULE 4</b>	<p>14. Visual acuity – visual angle, Components of Visual acuity ( Minimum visible, Resolution , Recognition Hyperacidity ), Factors affecting, Measurement of visual acuity.</p> <p>15. Color vision-</p> <ul style="list-style-type: none"><li>a. Physiological, Photochemical &amp; neurological basis of color vision</li><li>b. Electrophysiology of color vision</li><li>c. Granit’s modulator and dominator theory, Purkinje phenomenon. Young-Helmholtz theory</li><li>d. Types of color defects</li><li>e. Color blindness</li><li>f. Neural analysis</li></ul> <p><b>Module: 5</b></p> <p>16. Ocular Nutrition</p> <ul style="list-style-type: none"><li>a. Vitamin &amp; its Role in eye</li><li>b. Role of Antioxidant</li><li>c. Role of Omega 3 &amp; 6 Fatty acid in eye care</li></ul>
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**Reference books:**

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

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Paper code- ANATOMY (Ocular)

CODE: BO 203

Contact: 2L+1T

Credits: 3

Course Content	
<b>UNIT/MODULE 1</b>	<p><u>1. Embryology –ocular</u> Formation of optic vesicle &amp; optic stalk, formation of lens vesicle, formation of optic cup, changes in associated mesoderm, development of various structure of eye ball – retina, optic nerve, crystalline lens, cornea, sclera, choroid, ciliary body, iris, vitreous. Development of accessory structures of eyeball – eyelids, lacrimal apparatus, extra-ocular muscles, orbit. Milestones in the development of the eye. UNIT</p> <p><u>2. Orbit</u> Bony orbit→ Size, shape &amp; relations, walls of the orbit , Base of the orbit, Apex of orbit. Orbital fascia →Fascial bulbi, Fascial sheaths of extraocular muscles, inter-muscular septa. Spaces of orbit → Orbit fat &amp; reticular tissue - Apertures at the base of orbit- Contents of the orbit - Orbital nerve→oculomotor ,Trochler, Abducent, Trigeminal, facial nerves - their functional components, course &amp; distribution, clinically applied aspects. Cornea: Brief idea about ultra &amp; histological structure of cornea. Corneal transparency &amp; hydration. Regulation of corneal transparency &amp; hydration.</p> <p><u>3.Uveal Tract &amp; its vascular supply</u>→(a). Iris macroscopic &amp; microscopic appearance. (b) ciliary body – Macroscopic structure.(c). choroid - Macroscopic structure.(d) Blood supply to uveal structure- short &amp; Long Posterior artery &amp; Anterior Artery. (e). Venous drainage.</p>
<b>UNIT/MODULE 2</b>	<p>Lens: Basic idea about human lens. Function of lens. Lens transparency. Lens culture. Biochemical composition of lens. Lens protein – their types &amp; characteristics.</p> <p><u>Vitreous</u>- main masses of vitreous. Base of the vitreous. Hyaloidean vitreous. Vitreous cells.</p> <p><u>5.Sclera</u> – Anterior, posterior &amp; middle apertures. Episclera. Sclera proper. Lamina fusca. Blood supply of the sclera. Nerve supply of</p>



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	<p>the sclera.</p> <p>6. <u>Anterior chamber and its angle</u>- angle of the anterior chamber. Trabecular meshwork. Canal of Schlemm. Schwalbe's line. Drainage of aqueous humor.</p> <p>7. <u>Retina &amp; its vascular supply</u>→ (a). Gross anatomy,(b). Microscopic structure of fovea centralize, (c.) Anatomy of optic nerve, (d). Anatomy of optic nerve, (e.) optic chiasma optic tracts, (f) Lateral Geniculate body, (g). optic radicalism (h). visual cortex, (i). Arrangement of nerve fibers.( j). Blood supply of visual pathways (Arterial circle of willis &amp; its branches).</p>
<b>UNIT/MODULE 3</b>	<p>8. <u>The Ocular motor system</u>→ Extra ocular muscles, nerve supply, motor nuclei, supra nuclear motor centers.</p> <p>9. <u>The pupillary &amp; ciliary muscle</u>→Anatomy of sphincter &amp; Dilator muscle. Ciliary muscle – Anatomy, types 12. The nerve supply of the eye ball.</p> <p>10. <u>The lacrimal apparatus</u>→ (a) Lacrimal gland, (b) Palpebral part, (c) Duets of lacrimal gland, (d) structure of the lacrimal gland, (e) Blood supply &amp; nerve supply of the lacrimal gland, (f) lacrimal passages.</p>
<b>UNIT/MODULE 4</b>	<p>11. <u>Anatomy of the Ocular Adnexa &amp; glands; Lids</u> - 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 Zeis and Glands of Moll. Blood Supply of the Lids, Lymphatic Drainage of the Lids, Nerve Supply of the Lids.</p> <p>12. Conjunctiva - Palpebral Conjunctiva, Bulbar Conjunctiva, Conjunctival Fornix, Microscopic Structure of the conjunctiva- Epithelium, Substantia Propria. Conjunctival Glands→ Krause's Glands, Wofring's Glands, Henley's Glands, Manz Glands. Blood Supply of the Conjunctiva, Nerve Supply of the Conjunctiva, Caruncle, Plica Semilunaris.</p>

**Reference books:**

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

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**PAPER: ENVIRONMENT AND ECOLOGY**

**Code: BO -204**

**Contact: 1L+1T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<b>General</b> Introduction, components of the environment, environment degradation.  <b>Ecology</b> Elements of Ecology; Ecological balance and consequences of change, principles of environmental impact assessment.
<b>UNIT/MODULE 2</b>	<b>Air Pollution and Control</b> 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.  <b>Water Pollution and Control</b> Hydrosphere, natural water, pollutants: their origin and effects, river/lake/ground water pollution, standards and control.
<b>UNIT/MODULE 3</b>	<b>Land Pollution</b> Lithosphere, pollution (municipal, industrial, commercial, agricultural, hazardous solid wastes); their origin and effects, collection and disposal of solid waste, recovery and conversion methods.  <b>Noise Pollution</b> Sources, effects, standards and control.

**Reference books:**

1. *Environmental Studies – M.P. Poonia & S.C. Sharma, Khanna Publishing*
2. *ENVIRONMENT & ECOLOGY- SUNAKAR PANDA*

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**PAPER: COMPUTER FUNDAMENTALS**

**Code: BO -205**

**Contact: 1L+1T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	Basic computer Architecture: Fundamentals of Computers, Block diagram of PC, peripheral devices of PC and their functions
<b>UNIT/MODULE 2</b>	Input/Output: Input Devices, Output devices
<b>UNIT/MODULE 3</b>	Processor and memory
<b>UNIT/MODULE 4</b>	Storage Devices

**Reference book:**

1. *COMPUTER FUNDAMENTALS BY SINHA AND SINHA*
2. *COMPUTER FUNDAMENTALS BY R.S. SALARIA (KHANNA)*

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**PRACTICAL SYLLABUS**

**PAPER: PHYSICAL OPTICS**

**CODE: BO-291**

**Contact: 3P**

**Credits: 3**

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,

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**PAPER - COMPUTER**

**CODE: BO-292**

**Contact: 2P**

**Credits: 2**

- 1) Software and it's 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)

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- 5) Internet- Browser-set up home page, creating bookmark in browser, clearing history and browser cache, surfing,
  
- 6) 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,]
- 8) Rules for creating strong password and basic network security (Antivirus and firewall, protection from phishing mail)

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**3<sup>rd</sup> SEMESTER**

**Paper: VISUAL OPTICS (OPTICS III)**

**Code: BO -301**

**Contact: 3L+0T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Schematic and reduced eyes and their properties.</li><li><input type="checkbox"/> Optical constants of the eye and their measurement. Purkinje images. Corneal curvature and thickness. Indices of aqueous and vitreous.</li></ul>
<b>UNIT/MODULE 2</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> 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 &amp; resolving power.</li><li><input type="checkbox"/> Emmetropia and ametropia, Axial versus spherical ametropia, Myopia Hypermetropia(Hyperopia) Astigmatism. Aphakia, Anisometria, Anisokonia, Genetical aspects of refractive error.</li></ul>
<b>UNIT/MODULE 3</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Presbiopia-near vision addition- estimate of addition-unequal near vision addition- effect of changing the spectacle distance – hypermetropia and accommodation.</li></ul>

**Reference Books:**

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

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**Paper: BINOCULAR VISION & OCULAR MOTILITY**

**Code: BO -302**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	Grades of binocular vision Retinal Correspondence
<b>UNIT/MODULE 2</b>	Monocular cues Stereopsis and its tests
<b>UNIT/MODULE 3</b>	Accommodation convergence and its anomalies Anisometropia and Anisokonia
<b>UNIT/MODULE 4</b>	Binocular anomalies Ocular Movements

**Reference books:**

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



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**Paper: MICROBIOLOGY AND PATHOLOGY (GENERAL AND OCULAR)**

**Code: BO -303**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	<p><b>1. Bacteria</b> 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, ETC Sterilization-principles, types, methods . <b>Brief idea about general and Ocular antibiotics.</b></p> <p><b>2. Structure and functions of immune system</b> Structure and functions of immune system. Structure and functions of thymus, spleen, red bone marrow.</p>
<b>UNIT/MODULE 2</b>	<p><b>3. Virus</b> Elementary knowledge of viral morphology, viral genome and classification, viral replication, Herpes, Hepatitis and HIV virus.</p> <p><b>4. Immunity</b> Immunity and its types. Cell mediated and humoral immunity-mechanism. Antigen and antibody. Theories of Ab formation. Specific and Non-specific immunity.</p> <p><b>5. Graft rejection and cornea</b></p>
<b>UNIT/MODULE 3</b>	<p><b>6. Inflammation:</b> Types of inflammation. Changes associated with inflammation. Role of mast cell and platelet in inflammation</p> <p><b>7. Antimicrobial chemotherapy.</b> AIDS and related eye problem. BLEPHARITIS, KERATITIS, CONJUNCTIVITIS- brief overview</p> <p><b>8. Wound healing</b>-types, mechanism, factors regulating wound healing. Abnormalities in wound healing</p>
<b>UNIT/MODULE 4</b>	<p><b>Hypersensitivity</b>-Type I, II, III, IV <b>10. Autoimmunity</b>-mechanism <b>11 Ocular histology- Cornea and Conjunctiva</b></p>

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	<b>12. Disorders of growth</b> -metaplasia, dysplasia, neoplasia <b>13. Circulatory disturbance:</b> Thrombosis, infarction, ischaemia, embolism, calcification
<b>UNIT/MODULE 5</b>	<b>Ocular Pathology:</b> Corneal scraping, 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 GUPTA

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Paper: PHARMACOLOGY (GENERAL AND OCULAR)

Code: BO -304

Contact: 2L+1T

Credits: 3

Course Content	
UNIT/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.
UNIT/MODULE 2	<ul style="list-style-type: none"><li>□ 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.</li></ul>
UNIT/MODULE 3	Ocular <ul style="list-style-type: none"><li>□ Ocular penetration &amp; ophthalmic drug delivery system</li></ul> Topical anesthetics
UNIT/MODULE 4	<ul style="list-style-type: none"><li>□ Ophthalmic Drugs – Therapeutic: antibiotics, antiviral, antifungal, corticosteroids, viscoelastic agents. Antiglaucomic drugs, Ocular NSAIDS, Ocular lubricants, <b>cytokines</b>, Anti VEGF, Ocular antihistamine Diagnostics: Cyclopegic and mediatics, Ophthalmic Dyes.</li></ul>

**Reference books:**

1. ESSENTIALS OF MEDICAL PHARMACOLOGY- K.D. TRIPATHY,
2. OCULAR THERAPEUTICS- ASHOK GARG

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**Paper: OPTICAL AND OPHTHALMIC INSTRUMENTATION AND PROCEDURE-1**

**Code: BO -305**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	Detailed study of the Principles of operation, types, optical properties, constructions, adjustments and applications of the following Instruments and Devices: <ul style="list-style-type: none"><li><input type="checkbox"/> Telescopes: Optics &amp; Dispensing</li><li><input type="checkbox"/> Color Vision Test</li><li><input type="checkbox"/> Radiuscope</li><li><input type="checkbox"/> Retinoscopes</li></ul>
<b>UNIT/MODULE 2</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Standard Tests Charts: Visual Acuity, contrast sensitivity and projection chart</li><li><input type="checkbox"/> Autorefractometer- subjective and objective types</li><li><input type="checkbox"/> Ophthalmoscopes- Direct</li></ul>
<b>UNIT/MODULE 3</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Slit lamp Biomicroscope- <b>anterior segment</b></li><li><input type="checkbox"/> Keratometer</li><li><input type="checkbox"/> Lensometer</li></ul>
<b>UNIT/MODULE 4</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Trial case lenses-best forms.</li><li><input type="checkbox"/> Trial frame design.</li><li><input type="checkbox"/> Cross cylinder.</li></ul>

**Reference books-**

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

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**PRACTICAL SYLLABUS**

**Paper: MICROBIOLOGY & PATHOLOGY**

**Code: BO-391**

**Contact: 2P**

**Credits: 2**

1. Gram Staining of bacteria
2. Autoclaving of instruments and Glassware
3. Staining with Eosin Haematoxylin Leishmann Stain etc. -(Demonstration).

**Paper: OPTICAL AND OPHTHALMIC INSTRUMENTATION AND PROCEDURE-1**

**Code: BO-392**

**Contact: 2P**

**Credits: 2**

To study the operations of the following instruments:-

1. **Lensometer.**
2. **Retinoscope.**
3. **Standard Test Charts.**
4. **Autorefractometer.**
5. **Slit Lamp Examination- Anterior Segment**
6. **Keratometer.**
7. **DirectOphthalmoscope.**

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**4<sup>th</sup> SEMESTER**

**Paper: INTRODUCTION TO VISION SCIENCE**

**Code: BO -401**

**Contact: 2L+0T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	Neurophysiology 1. Geneculate cortex: a. Structure of geneculate 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)
<b>UNIT/MODULE 2</b>	3. Contrast Sensitivity – Types- (spatial & Temporal contrast sensitivity), Neural Mechanism, Measurement of contrast sensitivity ( Arden gratings , Cambridge low contest gratings, Pelli – Robson chart) 4. Visual stimulus, photometry and spectral sensitivity.
<b>UNIT/MODULE 3</b>	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.
<b>UNIT/MODULE 4</b>	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*

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**Paper: OCULAR DISEASE-1 (ANTERIOR SEGMENT DISEASE)**

**Code: BO - 402**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> 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.</li><li><input type="checkbox"/> Disease of the Lids -</li><li><input type="checkbox"/> Diseases of the Lacrimal Apparatus-.</li><li><input type="checkbox"/> Disease of the Conjunctiva</li></ul>
<b>UNIT/MODULE 2</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Disease of the Cornea</li><li><input type="checkbox"/> Disease of the Sclera</li></ul>
<b>UNIT/MODULE 3</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Disease of the Iris</li><li><input type="checkbox"/> Disease of the Ciliary Body</li></ul>
<b>UNIT/MODULE 4</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Glaucoma- Types and its Management (Basics Steps of Surgical Procedure)</li></ul> 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

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**Paper: CLINICAL REFRACTION- I**

**Code: BO -403**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ol style="list-style-type: none"><li>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.</li><li>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, Tait's. Other methods of retinoscopy-Radical, Near(Mahandra), Chromoretinoscopy, String Lensbar, use of objective and autorefractor.</li></ol>
<b>UNIT/MODULE 2</b>	<ol style="list-style-type: none"><li>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</li><li>4. Binocular Distance - T.I.B. (Turville Infinity Balance), Polarized - Target and polarized filter, fogging.</li></ol>
<b>UNIT/MODULE 3</b>	Near subjective refraction. Cycloplegic refraction, cycloidemia, sudden unfogging ,Borish delayed spherical end point, pinhole estimation of refractive error, stenopaic slit refraction, measurement of vertex distance, distometer, use of subjective autorefractor. Different methods of measuring amplitude of accommodation.
<b>UNIT/MODULE 4</b>	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*



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Paper: OPHTHALMIC LENS AND DISPENSING OPTICS

Code: BO-404

Contact: 2L+1T

Credits: 3

Course Content	
UNIT/MODULE 1	<p>Ophthalmic lens :</p> <p>1.Characteristics of lenses: Introduction. Spherical lenses. Plano-cylindrical lenses. Sphero-cylindrical lenses. Designation of lenspower. Power of lenses. Transposition. Base curve of spherical lens. Base curve of cylindrical single vision lens. Prism prescription and its application in dispensing.</p> <p>2.Spectacle lenses: Characteristics of lens materials. Specific gravity ( weight ). Refractive index. Abbe number. Impact resistance. Scratch resistance.Curve variation factor.</p> <p>3.Current materials: Crown glass. CR-39. High –index glass. High –index plastic. Poly carbonate. Photochromatic materials. trivex</p>
UNIT/MODULE 2	<p>4.Lens types: Single vision lens. Bi-focal lenses. <b>Concept of</b> Tri-focal lenses. progressive lenses.</p> <p>5.Ophthalmic lens coating: Anti- reflecting coatings. Special notes concerning anti-reflecting coatings. Protective coating, color coating. Mirror coating.</p> <p>6.Absorptive lenses: Classification of lens tints. Chemical that produces color&amp; assist in absorptive characteristics of glass lenses. Effect in prescription on lens color. Availability of tinted lenses.</p>
UNIT/MODULE 3	<p>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.</p> <p>8.Lens for special uses: Fresnel lenses. Thinlite lenses. Lenticular Lenses. Aspheric</p>

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	lenses. Atoric Lens, Introduction to filter 9. Fundamentals of Lens surfacing & quality.
<b>UNIT/MODULE 4</b>	<b>Basics of dispensing:</b> 1. Spectacle frame : Types, Materials, Measurement & Selection 2. Lens Selection: a) Ground rule for selection b) Selection criteria 3. Facial Measurement & Measuring heights
<b>UNIT/MODULE 5</b>	4. Pediatric Dispensing & Management 5. Verification of trouble shooting of Lens & Frames 6. Occupational dispensing & its management

**Reference book:** OPTHALMIC ASSISSTANT BY HAROLD A STEIN

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**Paper: OPTICAL AND OPHTHALMIC INSTRUMENTATION AND PROCEDURE-II**

**Code: BO -405**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	Principles, clinical use (methods) & significance of following instruments: <ul style="list-style-type: none"><li><input type="checkbox"/> Tonometer – Principles, types, clinical importance as a routine procedure (application)</li><li><input type="checkbox"/> Pachometer – Principles, types, clinical importance</li><li><input type="checkbox"/> Ultrasonography – (A scan, B scan) – Principles and application. And basics of UBM</li></ul>
<b>UNIT/MODULE 2</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> F.F.A – Principles and demonstration of film.</li><li><input type="checkbox"/> PAM – Principles and importance.</li><li><input type="checkbox"/> Perimeter – Basics of perimetry – Humphray instruments, Automated perimetry – basics, types(names) , interpretation of normal Glaucoma Field of Definition.</li></ul>
<b>UNIT/MODULE 3</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> 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)</li></ul>
<b>UNIT/MODULE 4</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Basics of OCT</li><li><input type="checkbox"/> Basics of Phoropter</li><li><input type="checkbox"/> Basics of Topography</li><li><input type="checkbox"/> Slit lamp biomicroscope- Posterior segment</li><li><input type="checkbox"/> Ophtalmoscope- Indirect type</li><li><input type="checkbox"/> Gonioscopy</li></ul>

**Reference book:**

1. *OPHTHALMIC ASSISTANT BY HAROLD A STEIN*

2. *CLINICAL OPHTHALMOLOGY- JACK J KANSKI*

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**Practical**

**Paper: CLINICAL REFRACTION**

**Code: BO-491**

**Contacts: 2P**

**Credits: 2**

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

**Paper: Ophthalmic Lens & Dispensing Optics**

**Code: BO-492**

**Contacts: 2P**

**Credits: 2**

- a) Find out the meridian & optical center of ophthalmic lens
- b) Neutralization –**Hand and Lensometer**
- c) Identification of lens-spherical, cylindrical & sphero-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
- i) Industry visit

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**Paper: OPTICAL AND OPHTHALMIC INSTRUMENTATION AND PROCEDURE-II**

**Code: BO-493**

**Contacts: 2P**

**Credits: 2**

Clinical use of the following instruments & the findings:

- Tonometer
- Slit lamp biomicroscope- Posterior segment
- Ophthalmoscope- Indirect type
- Gonioscopy
- Auto Perimeter-Normal HFA, printout interpretation
- A-scan:- Normal Print Out & analysis
- B-scan:- Normal Print Out & analysis
- OCT – Report Analysis
- Topography – Report Analysis

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**5<sup>th</sup> SEMESTER**

**Paper: LOW VISION AND VISUAL REHABILITATION**

**Code: BO -501**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	a) Definition-old, new, proposed b) Grades of low vision c) Epidemiology & Terminology of Low Vision
<b>UNIT/MODULE 2</b>	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
<b>UNIT/MODULE 3</b>	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
<b>UNIT/MODULE 4</b>	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*

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**Paper: CONTACT LENS**

**Code: BO -502**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	a) Contact lens history & development. Benefits of contact lens over spectacle. Manufacturing methods-spin cast, Lethé cut, Cast modeling. b) Measurement of Contact lens c) Contact lens optics-Contact lens & spectacle lens. Back vertex calculation. Contact lens & Tear lens system.
<b>UNIT/MODULE 2</b>	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. Patient selection & prescreening. Indications & contra indications of contact lens.
<b>UNIT/MODULE 3</b>	g) Fitting & Assessment of soft contact lens & RGP. h) care & maintenance of Soft contact lens and RGP. i) Writing contact lens prescription and order.
<b>UNIT/MODULE 4</b>	j) Modification of finished RGP lens. k) <b>Verification of</b> the parameters

**Reference book:**

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

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**Paper: CLINICAL REFRACTION-II**

**Code: BO -503**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	Assessment of children Vision & Paediatric evaluation, diagnosis & management. Amblyopia. Neuro- Optometric <b>Assessment and</b> Rehabilitation
<b>UNIT/MODULE 2</b>	Evaluation, Diagnosis & Optometric management of special children Visual Disorders in senior citizens, evaluation, diagnosis & management. Sports vision.
<b>UNIT/MODULE 3</b>	Refraction in special cases Behavioural optometry 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.



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**Paper: OCULAR DISEASE –II (Posterior segment and Neuro-Ophthalmic Disease)**

**Code: BO -504**

**Contact: 3L+0T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Diseases of the Vitreous Humour- Congenital Anomalies. Vitreous Opacities. Hereditary Vitreo – Retinal Degeneration’s. Vitreous Haemorrhage .Detachment of Vitreous Humour . Vitreous Surgery .</li><li><input type="checkbox"/> Methods of clinically assessing the posterior segment ( direct&amp; indirect ophthalmoscopy)</li></ul>
<b>UNIT/MODULE 2</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Disease of the Retina- Congenital &amp; 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. Injuries of the Retina.</li></ul> <p>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.</p>
<b>UNIT/MODULE 3</b>	Pupillary reaction Abnormal Pupillary Reactions Afferent pupillary conduction defects Argyll Robertson pupils Differential diagnosis of light-near dissociation Adie pupil
<b>UNIT/MODULE 4</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Visual Pathway defects</li><li><input type="checkbox"/> Migraine</li><li><input type="checkbox"/> Myotonic dystrophy &amp; blepharospasm</li></ul>

**Reference books:**

1. CLINICAL OPHTHALMOLOGY- JACK J KANSKI

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**Paper: PUBLIC HEALTH AND COMMUNITY OPTOMETRY**

**Code: BO -505**

**Contact: 2L+0T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ol style="list-style-type: none"><li>1. Concept of public health.</li><li>2. Principles of primary, secondary and tertiary care.</li><li>3. Planning of health services.</li></ol>
<b>UNIT/MODULE 2</b>	<ol style="list-style-type: none"><li>4. Health Policies</li><li>5. Role of Optometrist in managing eye camps</li><li>6. NPCB and refractive blindness – optometrist’s role as primary health care provides.</li><li>7. Health cares insurance including role of TPA.</li></ol>
<b>UNIT/MODULE 3</b>	<ol style="list-style-type: none"><li>8. Ocular emergencies –<ol style="list-style-type: none"><li>a) Foreign body</li><li>b) Eye Pain</li><li>c) Watering</li><li>d) Injuries-perforating, non perforating&amp; chemical</li></ol></li><li>9. Role of International organization and NGOs in eye care</li></ol>

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

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**Practical**

**Paper: LOW VISION AND VISUAL REHABILITATION**

**Code: BO-591**

**Contacts: 2P**

**Credits: 2**

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

**Paper: Contact Lens**

**Code: BO-592**

**Contacts: 2P**

**Credits: 2**

- 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.

**Paper: CLINICAL REFRACTION-II**

**Code: BO-593**

**Contacts: 2P**

**Credits: 2**

- 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

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**6<sup>th</sup> SEMESTER**

**Paper: SYSTEMIC CONDITION & THE EYE**

**Code: BO -601**

**Contact: 3L+0T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ol style="list-style-type: none"><li>1. Arterial Hypertension<ol style="list-style-type: none"><li>i) Pathophysiology, classification, clinical examination, diagnosis, complications, management.</li><li>ii) <b>Ocular Manifestations of Arterial Hypertension</b></li></ol></li><li>2. Diabetes mellitus<ol style="list-style-type: none"><li>i) Pathophysiology, classification, clinical features, diagnosis, complications, management.</li><li>ii) <b>Ocular Manifestations of</b> Diabetes mellitus</li></ol></li><li>3. Malignancy<ol style="list-style-type: none"><li>i) Definitions, nomenclature, characteristics of benign &amp; malignant neoplasms.</li><li>ii) Grading and staging of cancer, diagnosis, principles of treatment.</li></ol></li></ol> <p>Ocular Manifestations of Neoplasia</p>
<b>UNIT/MODULE 2</b>	<ol style="list-style-type: none"><li>4. Connective Tissue Disease<ol style="list-style-type: none"><li>i) Anatomy and pathophysiology: Arthritis.</li><li>ii) Ocular Manifestations of connective tissue disease.</li></ol></li><li>5. Thyroid Disease<ol style="list-style-type: none"><li>i) Anatomy and physiology of the thyroid gland.</li><li>ii) Classification of thyroid disease</li></ol></li></ol> <p>Diagnosis, complications, clinical features, management of thyroid disease involving eye</p>
<b>UNIT/MODULE 3</b>	<ol style="list-style-type: none"><li>6. Tuberculosis<ol style="list-style-type: none"><li>i) Etiology, pathology, clinical features, pulmonary TB, diagnosis, complications, treatment of tuberculosis involving the eye.</li></ol></li><li>7. Tropical Disease and the Eye<ol style="list-style-type: none"><li>i) Leprosy.</li><li>ii) Syphilis.</li><li>iii) Ocular Manifestations of Leprosy and syphilis</li></ol></li></ol>
<b>UNIT/MODULE 4</b>	<ol style="list-style-type: none"><li>8. Genetic disorders and the eye.</li></ol>

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Reference books: CLINICAL OPHTHALMOLOGY- JACK J KANSKI

**Paper: FUNDAMENTALS OF CLINICAL RESEARCH**

**Code: BO -602**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ol style="list-style-type: none"><li>1. Introduction to research</li><li>2. Types of research</li><li>3. Terminology</li><li>4. Steps involved in preparation of projects</li></ol>
<b>UNIT/MODULE 2</b>	<ol style="list-style-type: none"><li>5. Research ethics</li><li>6. Introduction about Biostatistics, variables, data, population sample, parameter statistics, scales of measurement.</li><li>7. Classification &amp; Presentation of data: Frequency distribution, Frequency polygon, Bar diagram, Histogram, Frequency distribution curve.</li><li>8. Descriptive statistics: Statistics of location, Mean Median Mode, Geometric mean, Range, Statistics of Dispersion, Mean Deviation, Standard Deviation, Coefficient of Variation. Correlation &amp; Regression.</li></ol>
<b>UNIT/MODULE 3</b>	<ol style="list-style-type: none"><li>9. Sampling Statistics: Sampling &amp; Sampling Distribution, Sampling Errors &amp; sampling statistics, Standard errors, Degree of freedom, Types of Sampling.</li><li>10. Introduction to Probability</li><li>11. Significance and student's T test</li></ol>
<b>UNIT/MODULE 4</b>	<ol style="list-style-type: none"><li>12. Experimental Design: Controlled and uncontrolled experiment.</li><li>13. Applications: Collection, presentation and analysis of hospital statistical data with examples. Collection, presentation and analysis of Optometric and ophthalmologic data with a few examples.</li><li>14. Case study</li></ol>

**Reference books:**

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

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**Paper: SPECIALIZED CONTACT LENS**

**Code: BO -603**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	<ol style="list-style-type: none"><li>1. Contact lens fitting in astigmatism.</li><li>2. Contact lens fitting in keratokonus.</li><li>3. Contact lens fitting in children.</li></ol>
<b>UNIT/MODULE 2</b>	<ol style="list-style-type: none"><li>4. Cosmetic and prosthetic contact lenses.</li><li>5. Contact lens – Toric, Bifocal, Multifocal.</li><li>6. Therapeutic lenses / Bandage lenses.</li></ol>
<b>UNIT/MODULE 3</b>	<ol style="list-style-type: none"><li>7. Recent advances in contact lenses.</li><li>8. Contact lens complications and their management.</li><li>9. Prosthetic eye fitting procedures &amp; conformers.</li></ol>

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

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**Paper: PROFESSIONAL PRACTICE MANAGEMENT**

**Code: BO -604**

**Contact: 2L+0T**

**Credits: 2**

<b>Course Content</b>	
<b>UNIT/MODULE1</b>	1. Law & Optometry <input type="checkbox"/> Laws governing medical and paramedical professions <input type="checkbox"/> Consumer act with respect to optometry and dispensing of optical Aids. <input type="checkbox"/> International optometry. <input type="checkbox"/> Personal and professional insurance (indemnity). <input type="checkbox"/> Ethics. <input type="checkbox"/> Negligence.
<b>UNIT/MODULE 2</b>	2. Basic Accountancy <input type="checkbox"/> Introduction. <input type="checkbox"/> Terms used in accounts, Principles of accountancy. <input type="checkbox"/> Journal & ledger <input type="checkbox"/> Trial Balance
<b>UNIT/MODULE 3</b>	Public relations. <input type="checkbox"/> Definitions. <input type="checkbox"/> PR- its disfunction from publicity, propaganda & advertising. <input type="checkbox"/> Internal and external aspects of PR <input type="checkbox"/> Phases of PR: analysis building, promotion of product or services, better employee, government and community relation.
<b>UNIT/MODULE 4</b>	3. Case Study:- ( at least ten Cases) as per format

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**Paper: APPLIED OPTOMETRY AND ORTHOPTICS**

**Code: BO -605**

**Contact: 2L+1T**

**Credits: 3**

<b>Course Content</b>	
<b>UNIT/MODULE 1</b>	Orthoptic Instruments Prism bar Synaptophore Maddox wing Maddox rod Hess screen Risley Prisms
<b>UNIT/MODULE 2</b>	Investigative Procedures <ul style="list-style-type: none"> <li>◆ Motor signs in squint               <ul style="list-style-type: none"> <li>A) Head position: Face turn, chin position, Head tilt.</li> <li>B) Cover test &amp; cover-uncover tests</li> <li>C) Maddox wing to assess heterophoria.</li> </ul> </li>   <li>◆ Assessment of degree of squint               <ul style="list-style-type: none"> <li>a)Hirschbag test.</li> <li>b) Prism bar test.</li> <li>c) Krimskey test</li> <li>d) Synoptophore test</li> </ul> </li> </ul>
<b>UNIT/MODULE 3</b>	<ul style="list-style-type: none"> <li>◆ Various Cranial nerve palsy – 3<sup>rd</sup>, 4<sup>th</sup> and 6<sup>th</sup></li> <li>◆ Assessment of ocular motility status               <ul style="list-style-type: none"> <li>a)Hess chart</li> <li>b)Diplopia testing</li> <li>c)Bielschowskys Head tilting test</li> </ul> </li> <li>◆ Assessment of visual sensory status in squint. Amblyopia Suppression Binocular single vision – SMP, Fusion, Stereopsis.               <ul style="list-style-type: none"> <li>◆ Types of squint – a) latent / manifest                   <ul style="list-style-type: none"> <li>b)horizontal / vertical</li> <li>c)paralytic / concomitant</li> </ul> </li> </ul> </li> </ul>
<b>UNIT/MODULE 4</b>	<b>Orthoptic Treatment Procedures</b> Management of – Convergenceinsufficiency



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	Amblyopia Suppression ARC Use of prism -For Exercise & correction Management of AMBLYOPIA
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**Reference book:** *THEORY AND PRACTICE OF SQUINT AND ORTHOPTICS- A.K.KHURANA*

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**Practical**

**Paper: SPECIALIZED CONTACT LENS**

**Code: BO -691**

**Contacts: 3P**

**Credits: 3**

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

**Paper: APPLIED OPTOMETRY AND ORTHOPTICS**

**Code: BO -692**

**Contacts: 3P**

**Credits: 3**

1. Demonstration of following Orthoptic instruments/methods and their uses –  
PrismBar  
Synaptophore  
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.