School of Health Sciences

CSJM University, Kanpur

Ordinance & Syllabus
for

Bachelor of Optometry
(B.Optom.)

Academic programme

Ordinance according to
NEP-2020

Duration:
3 Years (06 Semesters)
&
1 Year Internship

Bachelor of Optometry
(B.Optom.)

ORDINANCE

Chapter
"A"

About Optometry:
The Ministry of Health and Family Welfare, accepted in its entirety the definition of an allied and healthcare professional based on the afore-mentioned report, though the same has evolved after multiple consultations and the recommended definition is now as follows- 'Allied and healthcare professionals (AHPs) includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions. They work in multidisciplinary health teams in varied healthcare settings including doctors (physicians and specialist), nurses and public health officials to promote, protect, treat and/or manage a person('s) physical, mental, social, emotional, environmental health and holistic well-being.'
Blindness is a major handicap which if not get cared can be curse to a person. Timely diagnosis and referral can prevent most of blindness in the society. Optometry is a profession that has the primary public health responsibility for eliminating uncorrected refractive error (the leading cause of vision impairment globally). Optometry as a profession has the primary public health responsibility for eliminating uncorrected refractive error. To provide excellent vision care to all the people of the country, India needs 116,000 optometrists. India currently has approximately 9,000 4-year trained optometrists and an estimated 30,000 2-year trained eye care personnel. As primary eye care practitioners, optometrists have a vital role in detecting potentially serious eye diseases such as cataract, glaucoma and age-related eye disorders, as well as general health conditions such as hypertension and diabetes, which can cause various eye problems in masses, and their timely referral and in some cases co-management. Optometry can and should play a leading role in eye care provision at the primary level, and can also assist at secondary and tertiary levels where possible, working with ophthalmologists and other eye care providers towards the unified goal of combating blindness.

Course Objectives:
At the completion of this course, the student should –
1. Be able to develop skills to provide comprehensive eye examination:
a. To acquire knowledge on ocular structures, its functions and pathological changes
b. To carryout ophthalmic investigations
c. To impart knowledge with regard to common eye diseases
d. To impart knowledge on treatment modalities from the perspective of counselling
e. To acquire knowledge about the referral guidelines for ocular and systemic conditions
2. Be able to correct refractive error and provide spectacle prescription
3. Be able to fit, evaluate, prescribe and dispense contact lenses for refractive correction and other ocular conditions
4. Be able to assess the low vision and provide comprehensive low vision care
5. Be able to have adequate knowledge to develop skill in manufacturing of spectacle lenses, contact lenses and low vision devices.
6. Be able to do complete binocular vision assessment, manage non-strabismic binocular vision anomalies and refer condition which warrants surgery

7. Be able to assess the visual demands for various occupations and match it to the visual capabilities. Also be able to advice on eye safety wear for various occupations.
8. Have knowledge and skill for early detection of various ocular conditions and pathologies – Refractive error, Strabismus, Cataract, Diabetic retinopathy, Glaucoma etc.
9. Have knowledge regarding organizations of eye banks and preservation of ocular tissues.
10. Have knowledge on sensory substitution and other rehabilitation measures for totally visually challenged.
11. Have knowledge of counselling on visual/ocular hygiene, nutritional and environmental modifications

Course Outcomes:
1. Optometrist will work independently or in conjunction with other eye/health care professionals.
2. The optometrist will be knowledgeable, skilful and analytical in diagnosis, treatment planning, management of visual defects & impairments and in co-managements of ocular conditions.
3. The optometrist can work in hospitals (both private and public sectors), optical outlets and/or work as independent practitioner
4. The course will lead to a basic degree in optometry, which is considered as the minimum essential for statutory registration of optometrists in countries where optometry has been brought under legislation.
5. Undertake public health optometry projects and vision screening eye camps in schools, colleges, urban slums, rural areas and also practice occupational optometry in industries.
6. Public education on ocular hygiene and related nutritional and environmental counselling.
7. Offer a helping hand and or efficiently manage and successfully run any ophthalmic clinic, optometry department in hospitals, optical shops, and offer product expertise in ophthalmic industry & trade.

1. Bachelor of Optometry degree will be under the **faculty of Medicine** of C.S.J.M. University, Kanpur.

2. **Duration of Course :**
   - Bachelor of Optometry course will be a full time course.
   - Duration will be three years (06 Semesters) followed by compulsory 12 months (1 year) internship.

3. **No. of Seats :**
   Total no. of Students to this course **shall be 40.**

4. **Admission.**

   Eligibility Criteria:
   For admission in this course candidate has to pass 10 + 2 or its equivalent examination in Science conducted by any Board or University incorporated by law and recognized by this University with minimum 45% marks in aggregate in Physics, Chemistry & Biology/Mathematics (relaxation of 5% marks for SC/ST student).

   Mode of Admission:
   The candidates for admission to this course shall be selected through an entrance test conducted by the University/ procedure decided by the governing body of the institute or on the basis of merit of marks obtained (Physics, Chemistry & Biology/Mathematics) in 10 + 2 or its equivalent examination.

5. **Medium of instruction:**
English shall be the medium of instruction in the class and in the University examination.

6. **Method of Teaching:**
The method of teaching adopted shall be a combination of lectures, demonstrations and practicals by the full time faculty, visiting or part time or guest faculty.

7. **Examination:**
- As per the University norms

Duration of Examination:
- Each theory paper shall be of three-hours duration OR as per the University norms.

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8. **Attendance to appear in the end semester examination :**
The permission to appear in end semester examination shall be granted to such candidate only who have fulfill the condition of 75% attendance in each subject separately in theory and practical as per the university rule.
Regarding attendance requirements students will have to fulfill the condition of 75% attendance. 15% relaxation in attendance, in exceptional circumstances can be made by the Vice Chancellor on the recommendation of the Director/Coordinator/Head of the Institute/Department.

"B"

Regulations : Scheme of Examination

Bachelor of Optometry (First Semester) University Examination

S. No.	Subjects	Subject code	THEORY MARKS			PRACTICAL MARKS			Total marks
			Theory Paper	Internal Assessment	Total	Practical	Internal Assessment	Total	
1	General Anatomy & Ocular anatomy	BOPT-101	75	25	100	75	25	100	200
2	General Physiology & Ocular physiology	BOPT -102	75	25	100	75	25	100	200
3	General Biochemistry & Ocular Biochemistry	BOPT -103	75	25	100	-	-	-	100
4	Geometric optics-I	BOPT -104	75	25	100	75	25	100	200
								Grand Total	700

Bachelor of Optometry (Second Semester) University Examination

S. No.	Subjects	Subject code	THEORY MARKS			PRACTICAL MARKS			Total marks
			Theory Paper	Internal Assessment	Total	Practical	Internal Assessment	Total	
1	Geometric Optics-II	BOPT-201	75	25	100	75	25	100	200
2	Visual Optics	BOPT -202	75	25	100	75	25	100	200
3	Physical Optics	BOPT -203	75	25	100	75	25	100	200
								Grand Total	600

Bachelor of Optometry (Third Semester) University Examination

S. No.	Subjects	Subject code	THEORY MARKS			PRACTICAL MARKS			Total marks
			Theory Paper	Internal Assessment	Total	Practical	Internal Assessment	Total	
1	Optometric Optics-I	BOPT-301	75	25	100	75	25	100	200
2	Optometric instruments & clinical examination of visual system	BOPT-302	75	25	100	75	25	100	200
3	General Pathology	BOPT-303	75	25	100	75	25	100	200
4	General Microbiology	BOPT-304	75	25	100	75	25	100	200
								Grand Total	800

Bachelor of Optometry (Fourth Semester) University Examination

S. No.	Subjects	Subject code	THEORY MARKS			PRACTICAL MARKS			Total marks
			Theory Paper	Internal Assessment	Total	Practical	Internal Assessment	Total	
1	Optometric Optics-II	BOPT-401	75	25	100	75	25	100	200
2	General Pharmacology & Ocular Pharmacology	BOPT-402	75	25	100	-	-	-	100
3	Research Methodology & Biostatistics	BOPT-403	75	25	100	--	-	-	100
4	Epidemiology & Occupational Optometry	BOPT-404	75	25	100	-	-	-	100
								Grand Total	500

Bachelor of Optometry (Fifth Semester) University Examination

S. No.	Subjects	Subject code	THEORY MARKS			PRACTICAL MARKS			Total marks
			Theory Paper	Internal Assessment	Total	Practical	Internal Assessment	Total	
1	Ocular diseases-I	BOPT-501	75	25	100	75	25	100	200
2	Squint & Binocular Vision	BOPT-502	75	25	100	75	25	100	200
3	Low vision aids	BOPT-503	75	25	100	75	25	100	200
4	Clinical work	BOPT-504	-	-	-	75	25	100	100
								Grand Total	700

Bachelor of Optometry (Sixth Semester) University Examination

S. No.	Subjects	Subject code	THEORY MARKS			PRACTICAL MARKS			Total marks
			Theory Paper	Internal Assessment	Total	Practical	Internal Assessment	Total	
1	Ocular diseases-II	BOPT-601	75	25	100	75	25	100	200
2	Contact Lens	BOPT-602	75	25	100	75	25	100	200
3	Geriatric and pediatric optometry	BOPT-603	75	25	100	75	25	100	200
4	Clinical work	BOPT-604	.	.	.	75	25	100	100
								Grand Total	700

INTERNAL ASSESSMENT

- It will be for theory and practical both.
- It will be done through the whole semester.
- Candidate must obtain at least 40% marks in theory and practicals separately in internal assessment to be eligible for the semester university examination.

- **Internal assessment (Theory)** will be done as follows:

a)	Mid-term/ class test etc.	= 10 marks
b)	Assignments/Project/Quiz/ Presentations etc.	= 10 marks
c)	Attendance	= 05 marks
	Total	**= 25 marks**

- **Internal assessment (Practical)** will be done as follows:

a)	Laboratory Manual/Assignments/Class test etc.	= 10 marks
b)	Day to day performance/continuous evaluation/record etc.	= 10 marks
c)	Attendance	= 05 marks
	Total	**= 25 marks**

CRITERIA FOR PASSING

- As per the University Norms.

DIVISION:

- As per the University Norms.

INTERNSHIP

- A candidate will have to undergo internship for a period of twelve calendar months in a medical college/hospital equipped with modern laboratory facility or in a fully equipped laboratory, which fulfills the norms decided by the University.

DEGREE:

- The degree of Bachelor of Optometry (B.Optom) course of the University shall be conferred on the candidates, who have pursued the prescribed course of study for not less than six semesters and have passed examinations as prescribed under the relevant scheme and completed 12 months of compulsory internship.

Bachelor of Optometry
(B.Optom)
Syllabus

Course of Study

Bachelor of Optometry (First Semester)

			Teaching hours			Credit Hours
Sl.	**Subjects**	**Subject Code**	**Theory**	**Practical**	**Total**	
1.	General Anatomy and Ocular Anatomy	BOPT-101	60	60	120	06
2.	General Physiology and Ocular Physiology	BOPT-102	60	60	120	06
3.	General Biochemistry & Ocular Biochemistry	BOPT-103	80	-	80	04
4.	Geometric Optics-I	BOPT-104	60	60	120	06
				Total	**440**	**22**

Bachelor of Optometry (Second Semester)

			Teaching hours			Credit Hours
Sl.	**Subjects**	**Subject Code**	**Theory**	**Practical**	**Total**	
1.	Geometric Optics-II	BOPT-201	60	60	120	06
3	Visual Optics	BOPT-202	60	60	120	06
4	Physical Optics	BOPT-203	60	60	120	06
				Total	**360**	**18**

Bachelor of Optometry (Third Semester)

			Teaching hours			Credit Hours
Sl.	**Subjects**	**Subject Code**	**Theory**	**Practical**	**Total**	
1.	Optometric Optics –I	BOPT-301	60	60	120	06
2.	Optometric instruments & clinical examination of visual system	BOPT-302	60	60	120	06
3.	General Pathology	BOPT-303	60	60	120	06
4.	General Microbiology	BOPT-304	60	60	120	06
				Total	**480**	**24**

Bachelor of Optometry (Fourth Semester)

			Teaching hours			Credit Hours
Sl.	**Subjects**	**Subject Code**	**Theory**	**Practical**	**Total**	
1.	Optometric Optics-II	BOPT-401	60	60	120	06
2	General Pharmacology & Ocular Pharmacology	BOPT-402	80	-	80	04
3	Research Methodology and Biostatistics	BOPT-403	80	-	80	04
4	Epidemiology & Occupational Optometry	BOPT-404	80	-	80	04
				Total	**360**	**18**

Bachelor of Optometry (Fifth Semester)

			Teaching hours			Credit Hours
Sl.	**Subjects**	**Subject Code**	**Theory**	**Practical**	**Total**	
2.	Ocular diseases-I	BOPT-501	60	60	120	06
3.	Squint & Binocular Vision	BOPT-502	60	60	120	06
4.	Low Vision Aids	BOPT-503	60	60	120	06
5.	Clinical work	BOPT-504	-	80	80	04
				Total	**440**	**22**

Bachelor of Optometry (Sixth Semester)

			Teaching hours			Credit Hours
Sl.	**Subjects**	**Subject Code**	**Theory**	**Practical**	**Total**	
1.	Ocular diseases-II	BOPT-601	60	60	120	06
2.	Contact Lenses	BOPT-602	60	60	120	06
3.	Geriatric and Pediatric Optometry	BOPT-603	60	60	120	06
5.	Clinical work	BOPT-604	-	80	80	04
				Total	**440**	**22**

INTERNSHIP

- There shall be twelve months of Internship after the final year examination for candidates declared to have passed the examination in all the subjects.
- During the internship candidate shall have to work full time average 7 hours per day (each working day) for 12 Calendar months.
- Each candidate is allowed maximum of 6 holidays during entire Internship Program and in case of any exigencies during which the candidate remains absent for a period more than 6 days, he/she will have to work for the extra days during which the candidate has remained absent.
- The Internship should cover all the services provided by Ophthalmology department of medical college/hospital eg. OPD, IPD, OT & community services. Based on the attendance and work done during posting the Director/Principal/ head of institution/department shall issue '**Certificate of Satisfactory Completion**' of training following which the University shall award the Bachelor of Optometry Degree or declare the candidate eligible for the same.
- **No candidate shall be awarded degree without successfully completing twelve months internship**.
- Institution shall have to satisfy themselves that satisfactory infrastructure facilities of ophthalmology department exist in the Institute / Hospital where the internship training has to be undertaken. Following parameters / guidelines have been suggested:
  a. It is mandatory for the Institution to have its own well equipped and modern ophthalmology department.
  b. Senior ophthalmologist should manage the ophthalmology dept. in the Institutes/ Hospitals.
- Institute's Director / Principal can at his discretion grant NOC to the students to do the Internship at the place of his choice provided the concerned Hospital fully satisfies the above criteria. For the purpose of granting NOC the candidate shall have to submit to the Institution the status of ophthalmology services available at the place where he intends to do his Internship.

Bachelor of Optometry First Semester

General Anatomy and Ocular Anatomy
Subject Code: BOPT-101
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objectives:

- Students will be able to learn the terminology of the subject.
- To provide basic knowledge of cells, tissues, blood and to understand anatomy of human body**.**
- This subject will develop an understanding of the structure of organs and organ systems in normal human body**.**
- To enable the students to develop the basic concept of gross, functional and applied anatomy of various structures of the eye and adnexa

Learning Outcome- At the end of the course the student will develop the sense of co-relation between different anatomical and ocular structures on the basis of its location and functional aspects.

THEORY

1. **Introduction :**

Anatomy and its sub - division, planes of the body, terms in relation of structures, Regional Anatomy, organ system.

2. **Tissues of the body (Histology of the body tissues):**
   - Epithelium
   - Connective tissue
   - Bone and cartilage
   - Muscles: Skeletal, Smooth & heart muscle,
   - Blood vessels
   - Neuron, Neuroglia
   - Glands: Exocrine and Endocrine
   - Skin and appendages
   - Lymphoid Tissues
3. **Organ Systems: (General plan) :**
   - Locomotor system: Bones, muscles, joints.
   - Cardiovascular systems: Heart, Regional blood vessels – arteries, veins
   - Lymphatic system including immuno system
   - Digestive system
   - Respiratory system
   - Reproductory system
   - Endocrine system
4. **Anatomy of Central Nervous System :**
   - Central nervous system spinal and brain stem, cerebellum, cerebrum
5. **Ocular Anatomy :**
   - Eye – Sclera, cornea, choroid, ciliary body, iris, retina
   - Refractory media - Aqueous humor, anterior chamber, posterior chamber Lens, vitreous body
   - Eyelids, conjunctiva
6. **Development of Eye and Adenexa**

PRACTICAL

1. Identification and description of all anatomical structures.
2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts etc.
3. Practical Demonstration of Orbital structure.
4. Practical Dissection of bull's eye.
5. Demonstration of skeleton - articulated and disarticulated.

General Physiology and Ocular Physiology
Subject code - BOPT - 102
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objectives:

- Students will be able to learn the terminology of the subject**.**
- To provide basic knowledge of cells, tissues, blood and to understand physiology of human body**.**
- This subject will develop an understanding of the function of organs and organ systems in normal human body**.**
- To enable the students to understand the normal functioning of all structures of the eye and adnexa.

Learning Outcome: At the end of the course the student will be able to explain the physiological aspects of normal growth and development of the human body and understand physiological principles underlying pathogenesis and treatment of diseases.

THEORY

Physiology

1. **Cell :** Structure & function
2. **Blood**
   a) Blood cells
   b) Haemoglobin
   c) Blood groups
   d) Coagulation Factors
   e) Anaemia & Immunoglobulins
3. **Cardiovascular system**
   Heart rate, cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse
4. **Respiratory System**
   a) Ventilation
   b) Functions
   c) Lungs Volumes and capacities
5. **Gastrointestinal System**

Process of digestion in various parts

6. **Endocrinology**

a) List of Endocrine Glands
b) Hormones: Their secretion and functions (in brief)

7. **Excretion system**

a) Structure of nephron
b) Urine formation

8. **Skin** - Function & Structure
9. **Muscular System**

Classification of muscles & their functions

10. **Central Nervous System**

a) Parts
b) Sliding Filament Theory
c) Neuro Muscular Junction
d) Wallerian Degeneration

e) Motor Nervous system
   - Upper motor neuron system
   - Lower motor neuron system

f) Sensory nervous system
g) Sympathetic Nervous system
h) Parasympathetic nervous system

11. Special Senses - Ear and Eye (in detail)

Ocular Physiology :

- Protective mechanisms in the eye. Eyelid and lacrimation, description of the globe
- Extrinsic ocular muscles, their action and control of their movements
- Coats of the eyeball
- Cornea
- Aqueous humour and vitreous
- Intra ocular pressure
- Iris and pupil
- Crystalline lens and accommodation – presbyopia
- Retina structure & function
- Vision – general aspects of sensation
- Pigments of the eye and photo chemistry
- The visual stimulus, refractive errors
- Visual acuity
- Visual perception-binocular vision, stereoscopic vision, optical illusion
- Visual pathway, central & cerebral connections, lesions of pathways & effects
- Colour vision and colour vision defects

PRACTICAL

1. Demonstration of skeleton - articulated and disarticulated.
2. Component & setting of the compound microscope
3. focusing of object
4. Use of Low & High Power objective of microscope
5. Measurement of pulse, blood pressure
6. Elicitation of Reflexes & jerks
7. Identifications of blood cell by study of peripheral blood smears.

General Biochemistry & Ocular Biochemistry
Subject code - BOPT - 103
Min. Hrs. - Theory: 80 Hrs.

Learning Objectives:

- To provide general insight and basic knowledge of basics of biochemistry**.**
- The students will be given the basic of knowledge of chemistry and metabolism of various metabolites**.**
- To enable the students to understand structure, function and interrelationship of biomolecules and consequences of deviation from the normal.

Learning Outcomes:

- At the end of the course, the students should be able to demonstrate his knowledge and understanding on various conventional and specialized laboratory investigations and instrumentation, analysis and interpretation of a given data.
- At the end of the course the student will be able to explain principles of various conventional and specialized laboratory investigations and understand metabolic processes taking place in different ocular structures.

THEORY

1. Nutrition: RDA, BMR, SDA, caloric requirement and balanced diet.
2. Carbohydrates: Definition, classification and general functions. Carbohydrate Metabolism - Glycolysis, T.C.A cycle.
3. Lipids: Definition, classifications and general functions. Essential fatty acids and their importance, Cholesterol, Lipoproteins. Metabolism-□□Oxidation of fatty acids, fatty liver and ketosis.
4. Amino Acids : Definition, classification, essential and non essential aminoacids.
5. Proteins: Definition, classification, and Bio-medical Importance. Metabolism: Formation and fate of ammonia, Urea cycle and its significance.
6. Study of hemoglobin and myoglobin with their functions.
7. Enzymes: Definition, classification with examples, Factors affecting enzyme action, isoenzyme and co-enzyme, Clinical importance of enzymes.
8. Biochemistry of connective tissue - Introduction, various connective tissue proteins : collagen, elastin- structure and associated disorders.
9. Vitamins: Definition, classification and functions, dietary source, daily requirement and deficiency disorders.
10. Diabetes mellitus - definition, types & causes.
11. **Biochemistry of anterior segment of eye :**

– Importance of ocular biochemistry in clinical optometric practice.
– Tear film:- composition, lipid layer, aqueous layer, mucoid layer, functions, dysfunctions, diagnostic tests, tear substitutes, recent development.
– Cornea – biochemical composition of epithelium, bowman's layer, stroma, descemets layer, endothelium – functions, corneal metabolism, nutrient uptake energy, transparency, barrier mechanism, pump action, irrigating solutions, aging and other anomalies, recent developments.
– Lens – composition, metabolism, glucose utilization, sorbitol pathways, glutathione and ascorbic acid transport, transparency, cataract formation, aging, photooxidation, sugar cataract, cataract and ascorbic acid medical therapy – recent developments.
– Aqueous humour –composition – function –ciliary body – aqueous humour production – IOP-Glaucoma

12. **Biochemistry of posterior segment of eye :**

– Vitreous humour:– structure, composition, functions, vitreous biochemical pathology, intraocular gels, recent developments.
– Retina – Pigment epithelium structure, composition, photoreceptor cells – rhodopsin, lipids renewal, inner segment
– Pigment epithelium – choroid, metabolism and function, phagocytosis, vitamin A-retinal function and metabolism.

– Retinal neurochemistry: Monoamines – acetyl choline – gaba – amino acids – taurine – neuropeptides, Biochemical correlates of retinal diseases.

Geometric Optics-I

Subject code - BOPT - 104

Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objective- The objective of this course is to equip the students with a thorough knowledge nature of light, and properties of mirrors and lenses.

Learning Outcome- At the end of the course, the students will be able to differentiate between different types of the lenses and different lens system with their application.

THEORY

1. **Properties of Light, Refraction through spherical surfaces :**
   - Rectilinear propagation, reflection, refraction, ray, beam.
   - Umbra, penumbra, pinhole camera.
   - Introduction: Lens shapes, Vergences and conversion factors, divergence and convergence of wave fronts by spherical surfaces, definition of dioptre, Working of spherical lenses, primary and secondary focal points, predictable rays.
   - Prism diopter, Prentice's Law, deviations, Opthalmic prisms - thin and thick.
   - Spherical refracting interfaces - convex, concave, derivation of vergence equation, saggitas, dioptric power - focal points, nodal points and plane. Symmetry points, imaging examples, lateral magnification.
   - Thin lens equation - lenses in contact separated. Two lens systems, reduced system, vergence effectively equation.
   - Application - calculation of image points, dioptric powers in reduced systems using vergence techniques.
   - Thick lenses - front and back vertex powers, reduced system, dioptric power of equivalent lenses, cardinal points. Application - to calculate to the equivalent dioptric power of thick meniscus lens, plano convex vertex powers, position of principal planes. Dioptric powers using reduced systems. Matrix theory and lens matrices.
   - Cylindrical and spherocylindrical lenses: principle meridians, refraction by a cylindrical lens, calculation of power in different meridians, spherocylindrical lenses, circle of least confusion, interval of sturm, refraction through a sphero cylindrical lens, writing Rx in different forms (+cyl., meridional), additional sphero- cylinders, oblique- cylinders.
2. **Stops and Pupils:**
   - Aperture stop.
   - Entrance pupil and exit pupil.
   - Field stop.
   - Entrance port and exit port, field of view, vignetting.
   - Depth of field and depth of focus.
3. **Aberrations & Optical System:**
   - Dispersion by a prism - angular dispersion, dispersive power, Dispersion without deviation and deviation without dispersion, Achromatic prisms.
   - Chromatic aberrations - cause and methods of minimizing, achromatic doublet.
   - Monochromatic aberrations - first order and third order theory.
   - Spherical aberrations, coma, astigmatism, curvature, distortion - cause and the methods of minimizing aberrations.
   - Tangent condition for elimination of distortion.
   - Point spread function.

– Modulation transfer function.
– Fourier imaging theory.

PRACTICAL

- f & μ of convex lens (f by u-v and shift method).
- f & μ of concave lens (f of concave lens by u-v method, combined lens u-v method, R- Boy's method).
- μ of the prism (i-d curve).
- μ of slab - shift method (traveling microscope).
- μ of liquid - shift method (traveling microscope).
- f of convex mirror.
- f of concave mirror (μ-v graph).
- Verification of laws of reflection - plane mirror.
- Verification of laws of refraction - glass slab - pin method (μ by lateral shift).

Bachelor of Optometry Second Semester

Geometric Optics-II

Subject code - BOPT - 201

Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective: The objective of this course is to equip the students with a thorough knowledge of mirrors and lenses.

Learning outcome: At the end of this course, students will be able to predict the basic properties of the images formed on the retina by the optics of the eye.

THEORY

1. **Optical Instruments:**
   - Spectrometer.
   - Simple and compound microscope.
   - Telescope.
   - Magnifying power of simple and compound microscope, telescope.
   - Resolving power of optical instrument.
   - Resolving power of the eye.
   - Fiber Optics.
   - **Laser Optics:** Basic laser principles - spontaneous and stimulated emission, Coherence - spatial, temporal, Laser pumping - population inversion optical feedback. Gas lasers, and solid lasers, Helium neon laser – argon – ion laser – ruby laser. Monocular laser – carbandioixide, eximer laser. Semi-conductor lasers. Lasers in medicine ophthalmic applications.
   - Lens shapes, vergences and conversion factors, divergence and convergence of wave fronts by spherical lens.
2. **Principles of Lighting :**
   - Modern theory on light & colour: synthesis of light.
   - Additive and subtractive synthesis of colour.
   - Visual task: Factors affecting visual tasks.
   - Light & vision: Discomfort glare, visual ability, relationship among Lighting, visibility and task performance.
   - Light sources: Modern light sources, spectral energy distribution, luminous efficiency, colour temperature, colour rendering.
   - Illumination: Luminous flux, candela, solid angle, illumination, Utilization factor, depreciation factor, illumination laws.
   - Lighting system Design: Design approach, Design Process, Concept of Lighting design, physical consideration and psychological consideration and types of lighting.
   - Photometry: Measurement of illumination, photometers and filters.

PRACTICAL

- f & μ of convex lens (f by u-v and shift method).
- f & μ of concave lens (f of concave lens by u-v method, combined lens u-v method, R - Boy's method).
- μ of the prism (i-d curve).
- μ of slab - shift method (traveling microscope).
- μ of liquid - shift method (traveling microscope).
- f of convex mirror.
- f of concave mirror (μ-v graph).
- Verification of laws of reflection - plane mirror.
- Verification of laws of refraction - glass slab - pin method (μ by lateral shift).
- Resoling power of telescope.
- Photodiodes - characteristics.
- Plank's constant.

Visual Optics
Subject Code - BOPT - 202
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objective- To understand the fundamentals of optical components of the eye.

Learning Outcome-At the end of the course, the students will have theoretical knowledge and practical skill on visual acuity measurement, objective and subjective clinical refraction.

THEORY

1. **Review of Geometric Optics :**
   - Vergence and power.
   - Conjugacy, Object space and image space.
   - Sign convention.
   - Spherical Mirror.
   - Catoptric power.
   - Cardinal points.
   - Magnification.
2. **Optics of Ocular Structures :**
   - Cornea and aqueous.
   - Crystalline lens.
   - Vitreous.
   - Schematic and reduced eye.
   - Corneal curvature and thickness.
   - Keratometry.
   - Curvature of the lens and ophthalmophakometry.
   - Axial and axis of the eye.
3. **Refractive anomalies and their causes :**
   - Etiology of refractive anomalies.
   - Contributing variabilities and their ranges.
   - Populating distributions and their ranges.
   - Optical component measurement.
   - Growth of eye in relation to refractive errors.
   - Emmetropia.
   - Myopia.
   - Hyperopia.
   - Astigmatism.
   - Anisometropia and Aniseikonia.
   - Presbyopia.
   - Aphakia and pseudophakia.
   - Correction and management of Amblyopia.
4. **Far and near points of Accommodation and Vertex Distance :**
   - Correction of spherical Ametropia.
   - Axial versus refractive ametropia.
   - Relationship between Occomodation and convergence, A/C Ratio.
   - Ocular refraction versus spectacle refraction.
   - Ocular accommodation versus spectacle accommodation.
   - Spectacle magnification and relative spectacle magnification.
   - Retinal image blur. Depth of focus and depth of field.

5. Retinoscopy : Principles and Methods :

- Retinoscopy-speed of reflex and optimum condition.
- Retinoscopy-Dynamic and Static.
- Review of objective refractive method.
- Cross cylinder method for astigmatism, astigmatic fan test.
- Difficulties in objective tests and their avoidance.
- Transposition of lenses.
- Spherical equivalent
- Prescribing prism
- Binocular Refraction.

PRACTICAL

PART I

1. Study of purkinje images I & II, III &IV.
2. Measurements of corneal curvature and corneal thickness.
3. Mathematical models of the eye-Emmetropia, Hyperopia, & Myopia.
4. Conjugate points-demonstration,worked examples.
5. Axial and refractive hyperoia-worked examples.
6. Axial and refractive Myopia-worked examples.
7. Effect of lenses in front of the eye.
8. Effect of prism in front of the eye.
9. Vision through pinhole, slit filters etc.

PART II

1. Phorometry.
2. Visual acuity Stereoacuity in emmetropia.
3. Myopia and pseudomyopia, Myopia and visual acuity.
4. Hypermetropia determination of manifest error subjectively
5. Myopic correction-subjective verification-monocular and binocular. Demonstration of astigmatism. Use of slit and keratometry to find principle meridians. Stigmatism-subjective verification tests.
6. Measurement of accommodation –near and far points and range.
7. Presbyopic correction and methods – accommodative reserve balancing the relative accommodation –cross grid test.
8. Methods of differentiating axial and refractive ametropia.
9. Practice of retinoscopy-Emmetropia.
    - Spherical ametropia
    - Simple astigmatism
    - Compound myopia and hyperopia
    - Oblique and irregular astigmatism
    - In media opacities
    - In strabismus and eccentric fixation
10. Interpretation of cycloplegic retinoscopic findings
    - Prescription writing
    - Binocular refraction
    - Vision therapy
    - Photo refraction
    - Exercise for vergence

Physical Optics
Subject code - BOPT – 203
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective: The objective of this course is to equip the students with a thorough knowledge of the nature and properties of light.

Learning outcome: At the end of this course, students will be able to predict the distribution of light under various conditions.

THEORY

1. **Nature of light:**
   - Wave nature of Light - Short coming of wave theory
   - Quantum Theory - Dual nature of Light
   - Mathematical Representation of Wave – S.H.M. - energy composition of S.H.M. in a straight line and right angles
   - Huge's principle - Laws of reflection and refraction at spherical surfaces and lenses.
   - Description of the phenomena of interference, Young's experiment, coherent sources, phase and path difference, intensity, Theory of interference fringes.
   - Interference in thin films - Interference due to reflected and transmitted light – Lloyd's single mirror
   - Colours of thin films - wedge shaped thin films – testing of planeness of surface
   - Newton's rings experiment - refractive index of liquid
   - Non-reflecting films
   - Visibility of fringes - contrast and contrast threshold.
2. **Radiometry & Photometry:**
   - Radiant intensity
   - Irradiance
   - Lamberts cosine Law
   - Basic concepts and definitions in Photometry
   - Reflection co-efficient, transmission co-efficient, power-transmitted and reflected
   - Lummen Brodhun Photometer
3. **Diffraction and scattering:**
   - Single slit, qualitative and quantitative
   - Circular aperture
   - Double slit pattern and Kirchoff's integral
   - Multiple slits - grating
   - Reflection grating and the zone plate
   - Rayleigh's scattering
   - Raman scattering
4. **Polarisation :**
   - Polarisation of transverse waves - light as transverse waves.
   - Double refraction, principal plane, nicol prism - plane polarization.
   - Circular elliptic polarization production, detection and behavior.
   - Optical activity - Fresnal's half shade polarimeter.
   - Polarisation by selective absorption – dichorism.
5. **Spectrum :**
   - Sources of spectrum. Bunsen - carbon - mercury - sodium.
   - Emission and absorption spectra -classification, visible, ultra violet and infra spectra, electromagnetic spectrum.

PRACTICAL

1. Refractive index of prism for sodium D-Line using spectrometer.
2. Dispersive power of prism for Hg source using spectrometer.
3. Air wedge - Interference method to find diameter of an optically thin wire.
4. Newton's ring - to find of λ sodium light.
5. Biprism - To find λ of sodium light.
6. Diffraction grating - (Minimum deviation method). of Hg prominent lines.
7. Polarimeter - specific rotation of dextrose and concentration of IV injection.
8. Lummen brodem Photometer - Comparison of luminous power.
9. μ of liquid - using liquid prism - spectrometer.
10. Michelson interferometer -wavelength of laser light.

Bachelor of Optometry Third Semester

Optometric Optics-I

Subject code - BOPT - 301

Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective- To enable the students to gain thorough knowledge of different types of lenses used in optometry and ophthalmology and to measure the power of the lens using conventional technique.

Learning outcome- At the end of the course, the students will be able to transpose different types of lens prescription and identify different types of lenses along with their application in ophthalmology and optometry.

THEORY

1. **Spectacle Lenses :**
   - Introduction to spectacle lenses.
   - Forms of lenses.
   - Cylindrical and sphero cylindrical lenses.
   - Properties of crossed cylinders.
   - Toric lenses, toric transposition.
   - Astigmatic lenses.
   - Axis Direction of astigmatic lenses.
   - Obliquely crossed cylinders.
   - Sag Formulae.
   - Miscellaneous spectacle lenses.
   - Vertex distance and vertex power.
   - Tilt induced power.
   - Aberrations in ophthalmic lenses.
   - Fresnel prisms, Lenses and Magnifiers.
   - Manufacture of glass.
   - Lens surfacing.
   - Principle of surface generation and glass cements.
   - Lens quality.
   - Faults in lens material.
   - Faults on lens surface.
   - Inspecting te quality of lenses.
   - Toughened lenses.
2. **Ophthalmic Lenses :**
   - Definition of prisms, Units of prism power.
   - Thickness difference and Base apex notations.
   - Dividing, Compounding and Resolving prisms.
   - Rotary prisms and effective prism power in near vision.
   - Prismatic effect, decentration, Prentice Rule.
   - Prismatic effect of spherocylinsders and Plano cylinders.
   - Differential prismatic effects.

PRACTICAL

Practical work related to:

1. Spectacle lenses
2. Ophthalmic lenses
3. Spectacle frames & dispensing optics.

Optometric instruments & clinical examination of visual system

Subject code - BOPT - 302

Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objectives:

- To enable the students to gain thorough knowledge of optics, and application of the various optometric and ophthalmic instruments.
- To enable the students to perform various clinical optometry and ophthalmic procedure used for anterior and posterior segment evaluation.

Learning Outcomes:

- At the end of the course, the students will be able to operate different optometric and ophthalmic instruments and analyse their respective report.
- At the end of the course the students will be skilled in knowing the purpose, set-up and devices required for the test, indications and contraindications of the test, step-by-step procedures, documentation of the findings, and interpretation of the findings of the various clinical optometry procedures

THEORY

1. **Refractive Instruments :**
   - Test charts standards, choice of test charts.
   - Trial case lenses-Best form lenses.
   - Reractor head units, optical considerations of refractor units.
   - Trial frame design.
   - Near vision difficulties with units and trial frame.
   - Retinoscope-types available.
   - Adjustments of retionscopes – special features.
   - Cylinder retinoscopy.
   - Interpretation of objective findings.
   - Interpretation of objective tests-polarising and displacement etc, simultan test.
   - Projection charts.
   - Illumination of the consulting room special instruments.
   - Brightness acuity tester.
   - Vision analyzer.
   - Video acuity test.
   - Pupilometer, Lensometer, lens gauge or clock, Refractionometer, Keratometer and corneal topography.
2. **Other Instruments :**
   - Slit lamp.
   - Tonometer – Principle, uses and types.
   - Ophthalmoscopes and related devices.
3. **Special Equipments :**
   - Fundus camera.
   - Orthoptic instruments.
   - Colour vision testing devices.
   - Fields of vision and screening devices.
   - Opthalmic ultra sonography - ultrasound/ A scan/ Bscan/ UBM.
   - Electodiagnostics - ERG/VPG/EOG.
   - Nerve fiber analyzer.
   - Scanning laser devices.

PRACTICAL

1. **Demonstration of various instruments.**
2. **Clinical examination of the visual system :**
   - History of the ophthalmic subject.
   - Ocular symptoms, the past prescriptions-its influence.
   - Visual acuity testing-distance and near and colour vision.
   - Examination of muscle balance.
   - Examination of eye lids, conjunctiva & sclera.
   - Examination of cornea, lens.
   - Examination of iris, ciliary body and pupil.
3. **Special examinations :**
   - Examination of intraocular pressure & examination of angle of anterior chamber.
   - Ophthalmoscopy – (direct and indirect).
   - Examination of fundus.
   - Examination of lacrimal system.
   - Examination of orbit.
   - Macular function test.
   - Visual field charting – (central & periphery).
   - Neuro-opthalmological examination.

General Pathology
Subject Code: BOPT-303
Min. Hrs - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objectives:

- To provide general insight into the history and basics of General Pathology**.**
- To impart knowledge about general outline of pathology**.**
- To provide brief knowledge about basic procedure done in pathology laboratory.

Learning Outcome- At the end of the course students will have the knowledge in Inflammation and repair aspects as well as the Pathology of various eye parts and adnexa.

THEORY

1. Cell Injury and Cellular Adaptations.

a) Normal Cell
b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling.
c) Cell death: types- autolysis, necrosis, apoptosis & gangrene.
d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia.

2. Inflammation

a) Acute inflammation - vascular event, cellular event, inflammatory cells.
b) Chronic Inflammation - general features, granulomatous inflammation, tuberculoma.

3. Hemodynamic Disorders:

Edema, hyperemia, congestion, hemorrhage, circulatory disturbances, thrombosis, ischemia & infarction.

4. Neoplasia:

Definition, how does it differ from hyperplasia, Feature of Benign Tumor and Malignant Tumor
difference between benign tumor and malignant tumor.

5. Healing

Definition, different phases of healing, factors influencing wound healing.

PRACTICAL

1. Components & setting of the Compound microscope.
2. Focusing of object.
3. Use of low & high power objectives of microscope.
4. Use of oil immersion lens.
5. Care and Maintenance of the microscope.
6. Different types microscopy
   - Dark field microscopy
   - Fluorescence Microscopy
7. Electron Microscopy in brief.

GENERAL MICROBIOLOGY
Subject Code: BOPT-304
Min. Hrs - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objective:

- To provide knowledge of bacteria, Sterilization etc.

Learning Outcome-At the end of the course, the students will be able to understand the pathogenesis of the diseases caused by the organisms in the human body.

THEORY

1. **General characters and classification of Bacteria.**
2. **Characteristics of Bacteria**
   Morphology- Shape, Capsule, Flagella, Inclusion, Granule, Spore.
3. **Growth and Maintenance of Microbes**
   Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO_2 requirement, temperature, pH, light.
4. **Sterilization and Disinfection.**
   Physical agents- Sunlight, Temperature less than 100^0C, Temperature at 100^0C, steam at atmospheric pressure and steam under pressure, irradiation, filtration.
   Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.
5. **Culture Media**
   Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media
6. **Staining Methods**
   Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation
7. **Collection and Transportation of Specimen**
   General Principles, Containers, Rejection, Samples- Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood.
8. **Care and Handling of Laboratory Animals**
   Fluid, Diet, Cleanliness, Cages, ventilation, Temperature, Humidity, handling of Animals, Prevention of disease.
9. **Disposal of Laboratory/Hospital Waste**
   Non-infectious waste, Infected sharp waste disposal, infected non-sharp waste disposal.

PRACTICAL

1. Preparation of swabs/sterile tubes & bottles.
2. Preparation of smear.
3. Staining: Gram & Ziehl-Neelsen staining.
4. Identification of Culture Media.
5. Identification of instruments.
6. Identification of common microbes.

Bachelor of Optometry Fourth Semester

Optometric Optics-II
Subject code - BOPT - 401
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective-The objective is to equip the students with through knowledge of different types, materials, tints, properties, coating of spectacle lenses as well as different frames.

Learning Outcome- At the end of the course, the students will be able to dispense different lens according to the requirement as well as perform facial measurement and marking related to dispensing optics.

THEORY

1. **Tinted and protective lenses:**
   - Characteristics of tinted lenses.
   - Absorptive Glasses.
   - Polarising Filters.
   - Photochromic Filters.
   - Reflecting filters.
   - Bifocal lenses.
   - Trifocal lenses.
   - Progressive addition lenses.
   - Lenticular lenses.
   - Reflection from spectacle lenses, ghost images, Reflections in bifocals at the dividing line.
   - Antireflection coating, antiscratch coating, antifog coating, Mirror coating, edge coating, Hard Multi Coating (HMC)
   - Field of view of lenses
   - Size, shape of view of lenses
   - Aspherical lenses
2. **Spectacle Frames:**
   - Types and parts.
   - Classification of spectacle frames-material, weight, temple, position, coloration.
   - Frame construction, frame measurements and markings.
3. **Dispensing Optics :**
   - Surfacing and polishing glass lenses.
   - Glazing.
   - Frame manipulation and repair.
   - Facial measurements and frame choice.
   - Frame and dimension measurements of complete pair of spectacles.
   - Complete dispensing for subjects.
   - Special lenses – examination of specimens.
   - Lens faults in sections.
   - Measurements of assorted faces for spectacle.
   - Making and edging of bifocal lenses.
   - Edging of lenses for plastic, metal and rimless frames.
   - Joining plastics by different solvents.

PRACTICAL

Practical work related to

1. Spectacle lenses
2. Ophthalmic lenses

3. Spectacle frames & dispensing optics

General Pharmacology & Ocular Pharmacology
Subject code - BOPT - 402
Min. Hrs. - Theory: 80 Hrs.

Learning objective-The objective of the course is to covers the actions, uses, adverse effects and mode of administration of drugs, especially related to eyes.

Learning Outcome-At the end of the course, the students have thorough knowledge of the basic principle of pharmacokinetics & Pharmacodynamics as well as the commonly used ocular drugs, mechanism, indications, contraindications, drug dosage and adverse effects.

THEORY

1. **General Pharmacology :**
   - Introduction and sources of drugs
   - Routes of drug administration
   - Phrmacokinetics-special emphasis on ocular pharmacokinetics
   - Adverse drug reactions-Special emphasis on ocular toxicity of drugs
   - Factors modifying drug action
2. **Systemic Pharmacology :**
   - Autonomic Nervous System :- Introduction, Neurotransmitters, their mechanism of action, Drugs affecting-
     - Pupillary Size and Light Reflex,
     - Intraocular Tension,
     - Accommodation,
   - Skeletal Muscle Relaxants
   - Cardiovascular System: Antihypertensives and drugs useful in Angina
   - Central Nervous System: Alcohol, Sedative, Hypnotics, General anesthetics, Local anesthetics, Opiods and non opiods
3. **Others :**
   - Chemotherapy: Introduction, general chemotheraphy, Specific chemotherapy - Antifungal, Antiviral, Antitubercular & Antileprotic chemotherapy
   - Hormones: Corticosterids, Antidiabetics
   - Blood: Coagulants
   - Diuretics
4. **Ocular Pharmacology :**
   - Ocular preparations, formulations and requirements of an ideal agents.
   - Ocular pharmacokinetics-Methods of drug administration, Special drug delivery systems.
   - Ocular toxicology.
5. **Diagnostic and Theraputic applications of drugs in Opthalmology :**
   - Agents used to aid diagnosis.
   - Drugs and biological agents used in ocular surgery.
   - Anesthetics used in ophthalmic procedures.
   - Drug treatment of glaucoma, accommodative esotropia and ocular myasthenia
   - Pharmacotherapy of ocular infections-Bacterial, Viral, Fungal, Chlamydial.
   - Drugs used in inflammatory disorders of the eye.
   - Drug treatment of degenerative disorders of the eye.
   - Immunomodulators in ophthalmic practice.
   - Use of other agents in ophthalmic practice:- Enzymes, Vitamins, Trace elements, Antioxidants, Wetting agents, Tear substitutes.

Research Methodology and Biostatistics
Subject code - BOPT - 403
Min. Hrs. - Theory: 80 Hrs.

Learning Objective: The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings.

Learning Outcomes: The student will be able to:

- Describe the basic principles of research and methods applied to draw inferences from the research findings.
- Discuss the basic concepts of Biostatistics.
- Explain Design, Methodology of Experiment/Survey, Demography and vital statistics, sampling & interpretation of data.

THEORY

RESEARCH METHODOLOGY

1. Introduction to Research methodology:
   Meaning of research, objectives of research Motivation in research Types of research & research approaches, Research methods vs methodology, Criteria for good research.
2. Research problem:
   Statement of research problem, Statement of purpose and objectives of research problem, Necessity of defining the problem
3. Research design:
   Meaning of research design, Need for research design, Features for good design, Different research designs, Basic principles of research design.
4. Measurement & scaling techniques: Measurement in research-
   Measurement scales, sources of error in measurement, Technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques.
5. Methods of data collection: collection of primary data, collection data through questionnaires & schedules, Difference between questionnaires & schedules.
6. Computer technology:
   Introduction to Computers, computer application in research computers & researcher.

BIOSTATISTICS

1. **Introduction**: Meaning, definition, characteristics of statistics. Importance of the study of statistics, Branches of statistics, Statistics and health science , Parameters and Estimates, Variables and their types, Measurement scales.
2. **Tabulation of Data**: Basic principles of graphical representation, Types of diagrams – histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, Normal probability curve.
3. **Measures of Central Tendency**: Need for measures of central Tendency, Definition and calculation of **Mean** – ungrouped and grouped, interpretation and calculation of Median- ungrouped and grouped, Meaning and calculation of Mode, Geometric mean & Hormonic mean, Guidelines for the use of various measures of central tendency.
4. **Measures of Dispersion** : Range, mean deviation, standard deviation & variance.
5. **Probability and Standard Distributions:** Meaning of probability of standard distribution, the binominal distribution, the normal distribution, Divergence from normality – skewness, kurtosis.
6. **Correlation & regression :** Significance, correlation coefficient, linear regression & regression equation.
7. **Testing of Hypotheses , Level of significance, Degrees of freedom.**
8. **Chi-square test, test of Goodness of fit & student t-test.**
9. **Analysis of variance & covariance:** Analysis of variance (ANOVA), what is ANOVA? Basic principle of ANOVA, ANOVA technique, Analysis of Co variance (ANCOVA)

10. Sampling: Definition, Types- simple, random, stratified, cluster and double sampling. Need for sampling - Criteria for good samples, Application of sampling in community, Procedures of sampling and sampling designs errors.

Epidemiology & Occupational Optometry

Subject code - BOPT - 404

Min. Hrs. - Theory: 80 Hrs.

Learning objective-The objective of this course is to provide knowledge of general aspects of occupational health, Visual demand in various jobs, task analyzing method, visual standards for various jobs, occupational hazards and remedial aspects.

Learning Outcome-At the end of the course the students will be knowledgeable in visual requirements of jobs, effects of physical, chemical and other hazards on eye and vision; and will also be able to prescribe suitable corrective lenses and eye protective glasses.

THEORY

Epidemiology:

- Definition
- Basic Measurements in epidemiology (in brief)
- Incidence & prevalence
- Epidemiological studies (in brief)
- Definition of epidemic, endemic, sporadic, pandemic, exotic, zoonosis, epizootic & epornithic.
- Natural history of disease, Transmission of disease.
- Surveillance

Law and Optometry:

- Legal environment techniques-History – law and equity
- History and theory of licensure
- Licensure as a means of internal and external discipline- unprofessional conduct incompetence-gross immorality
- International optometry- important foreign optometry law.
- Optometrist in court
- Malpractice-theory of liability-damages-minimizing malpractice claims
- Insurances
- Negligence
- Ethics-Professional ethics
- Laws governing practice of medical and paramedical profession in India
- Registered councils of India- Medical council, Dental council, & Nursing council
- Present rules and regulations-laws regarding optical product manufacturers dispensing in India
- Opticians – are they registered? Dispensing opticians-rules in UK

Public Health and Community Optometry:

- Global medicine and evolution of public health in India
- Public health of optometry-concepts and implementation
- Health care delivery systems in India and determinants of health
- Levels of prevention-optometrist's role in community
- Concepts of national Health Programme
- Screening in population
- Epidemiology of Blindness-Cataract, Glaucoma & deficiency disorders
- Scope of geriatric ophthalmology in preventive and rehabilitation care
- National and international agencies in health plan
- Fundamentals of health economics, health plan
- Quality assessment in health delivery programmes

Occupational Optometry:

- Introduction to occupational health, hygiene and safety International bodies like ILO WHO, national bodies like labour institutes, National institutes of occupational health, national safety council etc.

Bachelor of Optometry Fifth Semester

Ocular Diseases-I

Subject code - BOPT - 501

Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objective-To enable the students to gain knowledge about the etiology, clinical features, investigation and complications of anterior segment ocular disorders.

Learning Outcome-At the end of the course, the students will be able to approach correct diagnosis and management of the anterior segment ocular disorder.

THEORY

1. **Ocular Adnexa :**
   - Congenital and developmental anomalies of eyelids, Blepharospasm, Ectropion and entropion, Trichiasis and Symblepharon, Eyelid inflammations , Eyelid tumours, Ptosis, Eyelid retractions, Eyelid trauma, Methods of lacrimal evacuation, Congenital and developmental anomalies of lacrimal system, Lacrimal obstructions, Lacrimal sac tumours, Lacrimal trauma, Ectasia and staphyloma, Scleritis and Episcleritis, Congenital and developmental anomalies of orbit, Orbital tumours, Orbit inflammations, sinus disorders affecting the orbit, Orbital trauma, specific inflammatory diseases, Tumors of epithelial origin, Glandular and adenexal tumours, Tumours of neuroectodermal origin, Vascular tumours, Xanthomatous lesions, Inflammatory lesions, Metastatic tumours, Degenerations and dystrophies:- Definitions, Miscellaneous conditions, Keratoconjunctivitis Sicca, Steven Johnson Syndrome, Ocular Rosacea, Atopic eye disorders, Benign Mucosal Pemphigoid – ocular pemphigoid , Vitamin A deficiency, Metabolic diseases associated with corneal changes.
2. **Lens :**
   - Aging process
   - Developmental defects.
   - Acquired lenticular defects.
   - Management of lenticular defects.
3. **Uveal Tract :**
   - Congential anomalies.
   - Primary and secondary diseases of iris and ciliary body.
   - Tumours.
   - Anomalies of papillary reactions.
   - Congenital anomalies of choroids.
   - Diseases of choroids.

PRACTICAL

1. Selection of patients of above diseases
2. History taking & maintaining logbooks
3. Plan of non nurgical management of above diseases

Squint & Binocular Vision
Subject code - BOPT - 502
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective- The objective of the course is to provide the students the basics of Binocular Vision and its clinical co-relation.

Learning Outcome-At the end of the course, the students will be able to demonstrate an indepth knowledge of the gross anatomy and physiology relating to the extra ocular muscles as well as the etiology, investigation and management of anomalies of binocular vision.

THEORY

1. **Spatial Sense :**
   - Evolution of binocular vision
   - Binocular fusion, suppression, rivalry & summation
   - Visual direction, local sign & corresponding points
2. **Panum's Space :**
   - Stereopsis
   - Development of Binocular vision
   - The longitudinal horopter
   - Neural aspects of binocular vision
   - Visually guided behaviour and aniseikonia
   - ARC
3. **Qualitative & Quantitative diagnosis of Strabismus :**
   - Esodeviation
   - Exodeviation
   - A-V Phenomenon
   - Cyclovetical squint
   - Psuedostrabismus
4. **Amblyopia and Eccentric fixation :**
   - Treatment of amblyopia
   - Special froms of strabismus
5. **Nystagmus :**
   - Non surgical management of strabismus

PRACTICAL

1. To identify the patients of above problems.
2. History taking & maintaining logbooks
3. Plan of non surgical management of above problems.

Low Vision Aids
Subject code - BOPT - 503
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective: To enable the students to have knowledge about epidemiology of visual impairment, types of low vision devices and its optical principles, clinical approach of the low vision patients, assistive devices for totally visually challenged, art of prescribing low vision devices and training the low vision patients.

Learning Outcome-At the end of the course, the student will be knowledgeable in the Clinical examination of Low vision subjects as well as prescribing Optical, Non-Optical, Electronic, and Assistive devices.

THEORY

1. **Identifying the low vision patients:**
   - History.
   - Diagnostic procedures in low vision case management.
2. **Optics of low vision aids :**
   - Refraction, special charts, radical radioscopy.
   - Evaluating near vision-amsler grid and field defects, prismatic scanning.
   - Demonstrating aids-optical, non optical, electronic.
3. **Teaching the patient to use aids including eccentric viewing training where necessary :**
   - Spectacle mounted telescopes and microscopes.
   - Guidelines to determine magnification and selecting low vision aids for distance, intermediate and near vision.
4. **Children with low vision :**
   - Choice of tests, aids in different pathological conditions.
   - Light, glare and contract in low vision care and rehabilitation
   - Bioptic telescope.
5. **Optical devices to help people with field defects :**
   - Contact lens combined system
   - Rehabilitation of the visually handicapped

PRACTICAL

1. Practical work related to above theory topics
2. Maintaining manual/ logbooks of the practical work.

Clinical work at Hospital
Subject code - BOPT- 504
Min. Hrs. - Practical: 80 Hrs.

Clinical work :

1. Case sheet
2. History taking
3. Lensometry
4. External examination
5. Test for phorias and tropias
6. Visual acuity
7. Objective Refraction
8. Subjective Refraction
9. Keratometry
10. Slit lamp examination [Applanation tonometry]
11. Drugs and method of application
12. Do's and Don'ts – pupillary dilatation
13. Direct ophthalmoscopes
14. Indirect ophthalmoscopes

The students shall do above the clinical work at Ophthalmology department of the hospital (including OPD & IPD).
They shall maintain logbooks of patients.
At the end of academic year their logbooks will be evaluated by the faculty concerned.

Bachelor of Optometry Sixth Semester
Ocular diseases-II
Subject code - BOPT - 601
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objective-To enable the students to gain knowledge about the etiology, clinical features, investigation and complications of posterior segment ocular disorders.

Learning Outcome- At the end of the course, the students will be able to approach correct diagnosis and management of the anterior segment ocular disorder.

THEORY

1. **Vitreous and Retina :**
   - Developmental abnormalities, Hereditary hyaloidoretinopathies, Juvenile retinoschisis, Asteroid hyalosis, Cholesterolosis, Vitreous haemorrhage, Blunt trauma and the vitreous, Inflammation and vitreous, Parasitic infestations, Pigment granules in vitreous, Vitreous complications in cataract surgery, Retinal vascular diseases, Diseases of choroidal vasculature, Bruchs membrance and retinal pigment epithelium, Retinal tumours , Retinoblastoma, Phakomatoses, Retinal vascular anomalies, Retinal and optic nerve head astrocytomas, Other retinal disorders, Retinal inflammations, Metabolic diseases affecting the retina, Miscellaneous disorders, Electromagnetic radiation effects the retina, Retinal physiology and psychophysics, Hereditary macular disorders including albinism, Peripheral retinal degenerations, Retinal holes and detachment, Intraocular foreign bodies, Photo coagulation.
2. **Others :**
   - Neuro ophthalmic examination : History , Visual function testing , Technique of pupilary examination , Ocular motility, Checklist for testing , Visual sensory system, The retina, The optic disc, The optic nerve, Optic chiasma, Optic tracts, Lateral geniculate body, Optic radiations, Visual cortex, Visual field, Blood supply of anterior and posterior visual systems, Disorders of visual integration
   - Ocular motor systems: Saccadic system, Clinical disorders of saccadic system, Gaze palsies, Progressive supranuclear palsy, Parkinson's diseases, Ocular motor apraxia, Ocular oscillation, Smooth pursuit system and disorders, Vergence system, Cerebeller system, Non visual reflex system, Position maintenance system, Nystagmus, Ocular motor nerves and medical longitudinal fasciculus, The facial nerve, Pain and sensation from the eye, Autonomic nervers system 32, Selected systemic disorders with neuro ophthalmologic signs.
   - An overview of glaucoma: Aqueous humour dynamics – gonioscopy Evaluation of optic nerve head, Visual fields, Glaucoma screening, Classification of glaucoma , Primary open angle glaucoma, Primary angle closure glaucoma , Primary congenital glaucoma, Secondary glaucoma, Principles of medical therapy, Other modalities of glaucoma treatment, Social implications, Rationale in therapy.
   - Drug induced ocular diseases, eye and systemic diseases: arterial hypertension, diabetes mellitus, acquired heart diseases – embolism, cancer – introduction, connective tissue diseases, Thyroid disease, tuberculosis , helminthiasis, common tropical medical aliments, malnutrition, introduction to immunology, neurological disorders, general medical emergencies – first aid, genetics.

PRACTICAL

1. Selection of patients of above diseases
2. History taking & maintaining logbooks
3. Plan of non-surgical management of above diseases

Contact Lens
Subject code - BOPT - 602
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning objective: To enable the students to have knowledge in both theoretical and practical aspects of Contact Lenses.

Learning Outcome-At the end of the course, the students will be able to understand the basics of contact lens as well as its fitting and assessment.

THEORY

1. **History of Contact Lens :**
   - Corneal anatomy and physiology.
   - Corneal physiology and contact lens.
   - Preliminary measurements and investigations.
   - Slit lamp biomircoscopy.
   - Contact Lens Materials.
   - Optics of Contact Lens.
   - Glossary of terms: Contact Lenses.
2. **Indications and Contraindications of Contact Lenses**
   - RGP contact lens design.
   - Soft contact lens design.
   - Keratometry, Placido's disc, Topography.
3. **Fitting Philosophies [Introduction to Contact Lens fitting] :**
   - Handling of CL.
   - Fitting of spherical soft CL and effects of parameter changes.
   - Astigmatism: Correction options.
   - Fitting spherical RGP CL, low DK and high DK.
   - Effects of RGP CL parameter changes on lens fitting.
   - Fitting in astigmatism.
   - Fitting in keratoconus.
   - Fitting in aphakia , pseudophakia.
   - Lens care and hygiene instructions compliance.
   - Follow up post fitting examination.
   - Follow up slit lamp examination.
   - Cosmetic CL.
   - Fitting CL in children.
4. **IC CL :**
   - Bifocal CL.
   - Continuous wear and extended wear CL.
   - Therapeutic CL/Bandage lenses.
   - CL following ocular surgeries.
   - Disposable CL, Frequent replacement lenses.
   - Use of secular microscopy and pachymetry in CL.
   - Care of CL, CL solutions.
   - Complications of CL.
   - CL modification of finished lenses.
   - Instrumentation in CL practice.
   - Checking finished lens parameters.

- CL-special purpose-swimming,sports, occupational etc.
- Recent developments in CL.
- Review of lenses available in India.
- Currnet CL research

5. Dispensing Optics :

- Curvature and power measurements of typical contact lenses.
- Edging and polishing curves of contact lenses.
- Visit to factories making lenses and contact lenses.

PRACTICAL

1. Patient Selection (Type of Contact Lens).
2. Performing Procedure of contact leans fitting :

   Procedures for soft Lens :
   - Fitting of trial based on the refractive correction & keratiometry
   - Slit lamp examination to assess the fitting of CL
   - Perform over refraction
   - Prescribe the final basecurve & power of CL

   Procedures for RGP Lens :
   - Fitting of trial lens based on the refractive correction & keratometry
   - Evaluate the fluoresce in pattern under the slit lamp to finalise the base curve of the CL
   - Select the trial lens with the final base curve & required power
   - Perform over refraction
   - Prescribe the final base curve & power of contact lens
3. Patient Selection (Type of Contact Lens).
4. Performing Procedure of contact leans fitting :

   Procedures for soft Lens :
   - Fitting of trial based on the refractive correction & keratiometry
   - Slit lamp examination to assess the fitting of CL
   - Perform over refraction
   - Prescribe the final basecurve & power of CL

   Procedures for RGP Lens :
   - Fitting of trial lens based on the refractive correction & keratometry
   - Evaluate the fluoresce in pattern under the slit lamp to finalise the base curve of the CL
   - Select the trial lens with the final base curve & required power
   - Perform over refraction
   - Prescribe the final base curve & power of contact lens

Geriatric & Pediatric Optometry
Subject Code - BOPT - 603
Min. Hrs. - Theory: 60 Hrs. & Practical: 60 Hrs.

Learning Objective-The objective of the course is to provide the students with the knowledge of general and ocular physiological changes of ageing, common geriatric systemic and ocular diseases, clinical approach of geriatric patients and spectacle dispensing aspects in ageing patients as well as the development of the eye and vision, vision assessment and management of vision disorder in pediatric patients.

Learning Outcome-At the end of the course, the students will be able to examine and manage pediatric as well as geriatric patients.

THEORY

Pediatric Optometry

1. **History :**
   - Genetic factors ,Prenatal factors, Perinatal factors
   - Postnatal factors, Measurement of visual acuity, normal appearance, pathology and structural anomalies., Orbit, Eyelids, Lacrimal system Conjunctiva, Cornea, Sclera, Anterior chamber, uveal tract, pupils, Lens, Vitreous, Funds, Oculomotor system, Measurement of refractive status, Determining binocular status, Determining sensory motor adoptability
2. **Compensatory treatment and remedial therapy for :**
   - Myopia, Pseudo myopia, Hyperopia, Astigmatism, Anisometropia & Amblyopia
3. **Remedial and compensatory treatment for strabismus and Nystagmus :**
   - vergence and accommodation

Geriatric Optometry:

1. Structural changes in the eye.
2. Physiological changes in the eye.
3. Optical and refractive changes in the eye.
4. Aphakia, psuedophakia-it's correction.
5. Ocular diseases common in old eye, with special refrence to cataract disorders, vascular diseases of the eye
6. Special considerations in Ophthalmic dispensing to the elderly

- Management of visual problems of aging
- How to carry on one's visual tasks overcoming the problems of aging.

PRACTICAL

1. Practical work related to pediatric & geriatric optometry.
2. Maintaining manual/ logbooks of the Practical work

Clinical work at Hospital
Subject code - BOPT- 604
Min. Hrs. - Practical: 80 Hrs.

Clinical work :

1. Case sheet
2. History taking
3. Lensometry
4. External examination
5. Test for phorias and tropias
6. Visual acuity
7. Objective Refraction
8. Subjective Refraction
9. Keratometry
10. Slit lamp examination [Applanation tonometry]
11. Drugs and method of application
12. Do's and Don'ts – pupillary dilatation
13. Direct ophthalmoscopes
14. Indirect ophthalmoscopes

For Contact Lens Patients :

1. Patient selection [Type of Contact lens]
2. Performing Procedure of contact lens fitting

The students shall do above the clinical work at Ophthalmology department of the hospital (including OPD & IPD).

They shall maintain logbooks of patients.

At the end of academic year their logbooks will be evaluated by the faculty concerned.