GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-VI
Course Title: Ophthalmic Instrumentation
(Course Code: **4360306**)

Diploma programmer in which this course is offered	Semester in which offered
Biomedical Engineering	sixth

1. RATIONALE

Ophthalmology is a medical specialty that focuses on the study and treatment of disorders and diseases related to the eyes and visual system. Ophthalmic instruments play a crucial role in the diagnosis, monitoring, and treatment of various eye conditions, allowing ophthalmologists to provide effective and precise care to their patients. This is continually evolving with advancements in technology, leading to improved diagnostic tools and innovative treatment options.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **To equip the necessary skills and knowledge to understand, operate and maintain ophthalmology instruments.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

A. Identify parts of human eye along with its functions.
B. State the properties of light and color theory.
C. Describe various types of eye diseases and primary eye care.
D. Demonstrate different type of ophthalmic instruments.
E. Classify problems related to ophthalmic instruments and maintaining procedure.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	4	5	70	30	25	25	150

*(*):Out of **30 marks** under the theory CA, **10 marks** are for assessment of the **micro-project** to facilitate integration of COs and the remaining **20 marks** is the **average of 2 tests** to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.*

***Legends: L**-Lecture; **T –** Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C –** Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES:

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

Sr.No.	***Practical Outcomes (PrOs)***	***Unit No.***	***Approx Hrs. Required***
1.	Identify different parts of an eye using human eye model.	1	2
2.	Perform snell's law of refraction of light.	2	2
3.	Conduct a test of color vision using Ishihara Color Charts.	2	2
4.	Categorized various eye disease based on their symptoms.	3	2
5.	Identify the problems of eye by analyzing the OCT Image.	4	4
6.	Interpret information of an eye by an electroretinography.	4	4
7.	Carry out routine eye examination using trial lens set.	4	4
8.	Identify an essential parts of slit lamp machine.	4	4
9.	Scrutinize the procedure of retinoscopy.	4	4
10.	Examine eye structure using direct ophthalmoscope.	5	4
11.	Measure intra ocular pressure of an eye by using tonometer.	5	4
12.	Determine Standard Operating Procedure (SOP) for an Keratometer.	5	4
13.	Study various modes of ultrasound used for an eye examination.	5	4
14.	Identify parts of phaco-emulsification machine use to treat cataract.	5	4

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Sr.No.	**Equipment Name with Broad Specifications**	**PrO. No.**
1	**Model of Eye ball dissected:** It should have following features : Tunica external: It should show cornea and sclera with attachments of ocular muscles and optic nerve. Tunica media: It should show the iris, the culinary body and the choroid Tunica internal is retina. Refraction media: It should show the lens and the vitreous body. It should be available in the size of Approx 15 cm.	1

Sr.No.	Equipment Name with Broad Specifications	PrO. No.
2	**Color Vision Chart:** Animal Picture Chart for preverbal children. Ishiharas colour vision chart. Standard ishiharas pseudo - isochromatic plates in booklet form. Standard key for interpretation.	3
3	**Snellen Eye Chart:** Used for testing the eye sight of children or adults, Non reflective, matte finish plastic, Brass eyelet reinforced hole, Chart size 22" x 11", 20 foot test distance	7
4	**Slit Lamp:** Should have LED with adjustable and good illumination. Should have facility for applanation tono meter if required. Type of microscope: Binocular Should have 3 step magnification and total magnification is grater than 10x. Should have slit width ≥ 0-10 mm, adjustable. Should have slit length ≥ 0-10 mm, adjustable. Should have standard filters: Minimum: blue, green (redfree), heat absorption. A broader selection of filters increases the functionality of the slit lamp. Rotation is between 0-180°. Should be supplied with motorized table. Should have a longitudinal movement of at least 90mm. Should have a lateral movement of at least 95mm. Should have a vertical movement of at least 30mm. Should have a chin rest vertical movement of at least 55mm.	8
5	**Retinoscope:** Available with LED light source. Should be interchangeable to plane mirror and concave mirror mode by sleeve movement. Should have an external focusing sleeve which is easy to grip. Should have crossed-linear polarizing filter. Should allow one-hand operation for streak focus. Available with 360º streak rotation. Should have 100% dust proof housing and multi-coated optics	9
6	**Ophthalmoscope Direct:** Available with LED/Halogen light source. Magnification up to x15 from direct vision to maximum magnification. Red-free, blue and polarization filters and Anti-reflection lens. Should have small and large spot sizes, fixation targets, slit aperture, hemi-spot and cobalt blue filter. Should be rechargeable battery with Charger / battery/ mains operated. At least 3 apertures and fixation star. Range of lenses not smaller than -30D to +20D with steps not greater than 1D.	10
7	**Non Contact Tonometer:** Measurement range - 1 mm Hg to 60 mm Hg or higher range. Working Distance - 11 mm. Eye fixation - inner fixation light. Intra Ocular Pressure Compensation by corneal thickness. Result Display – 5.7" VGA Colour LCD. **Applanation Tonometer:** Measuring range: from 0 to 80 mmHg in 2 mmHg increments ±0,5 mmHg, Diameter of the pneumatic face: 3,06 mm Measurement: 47 mm Wide x 30 mm high Weight: 725 g.	11

7. AFFECTIVE DOMAIN OUTCOMES

The following sample Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfil the development of this competency.

A. Fostering a sense of responsibility for proper handling, maintenance and calibration of ophthalmic equipments.
B. Instilling ethical values in the use of ophthalmic equipment.
C. Recognizing the collaborative nature and developing interpersonal skills to effectively work with colleagues, Technicians and other healthcare professionals.
D. Embracing a mindset of lifelong learning, staying updated on advancements in ophthalmic technology and incorporating new skills into practice.
E. Prioritizing safety protocols and precautions associated with ophthalmic instruments, ensuring a secure environment for both practitioners and patients.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year.
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY:

Unit	Unit Outcome (UO)	Topic and Sub-topic
Unit-1 Anatomy and physiology of an eye	1a. Draw and explain anatomy of an eye. 1b. Sketch accessory part of an eye with its significance. 1c. Describe visual pathway with proper diagram. 1d. Explain Schirmer's test of an eye. 1e. Elaborate ocular muscles and ocular movement.	1.1 Structure of an eye: Cornea, Sclera, Choroid, Pupil, Iris, Lens, Vitreous body, Retina, Optic nerve 1.2 Accessory part of an eye: Lacrimal apparatus, Eye lid, Conjunctiva, Ocular muscles 1.3 Physiology of eye: Vision, Ocular movement, Visual Pathway
Unit-2 Physical & Geometric Optics and Color theory	2a. List out properties of light and laser. 2b. State the Laws of Refraction. 2c. What happened when light waves interact with an object? 2d. Explain color theory. 2e. Classify color blindness and explain test for detection of color blindness.	2.1 Properties of light, Visible light and eye, light waves interaction with an object, Lasers in ophthalmology 2.2 Color theory, Color blindness, Classification of color blindness, Test of color blindness: Ishihara Color Charts, Holmgren colored wool, lantern test
Unit-3 Eye disease and Primary eye care	3a. Describe myopia, hyperopia and astigmatism. 3b. Write down symptoms and treatment of conjunctivitis, trachoma, corneal ulcer, eye opacity, irises, cataract, glaucoma, squint, retinal detachment, diabetic retinopathy disease. 3c. List out conditions of ocular emergency. 3d. Write down role of ophthalmic assistant in primary eye care.	3.1 Common eye disease: Refractive error, Conjunctivitis, Trachoma, Corneal Ulcer, Eye Opacity, Irises, Cataract, Glaucoma, Squint, Retinal detachment, Diabetic retinopathy 3.2 Ocular Emergency 3.3 Role of Ophthalmic assistant
Unit-4 Ophthalmic diagnostic Procedures	4a. Elaborate visual acuity in detail. 4b. Explain procedure of optical coherence tomography. 4c. Classify different wave of ERG. 4d. Describe fluorescein angiography. 4e. Identify different part of slit lamp.	4.1 Visual Acuity 4.2 Optical Coherence Tomography 4.3 Electroretinography 4.4 Fluorescein Angiography 4.5 Refractive instruments-Trial set, slit lamp

Unit-5 Ophthalmic equipments and Ethics in Ophthalmic Practice	5a. Identify part of ophthalmoscope and explain direct and indirect Ophthalmoscopy. 5b. Categorized different type of tonometer for finding IOP. 5c. Explain fundus camera. 5d. Describe procedure to use keratometer machine. 5e. Explain phoco-emulsification machine in details. 5f. List out common problems found in ophthalmic instruments. 5g. Elaborate maintaining procedure of ophthalmic instruments.	5.1 Ophthalmoscopy- Direct and Indirect 5.2 Tonometer, Fundus camera, Keratometer 5.3 Phaco-emulsification 5.4 Ultrasonography in ophthalmology 5.5 Common problems found in ophthalmic instruments 5.6 Maintenance of ophthalmic instruments and ophthalmology ethics

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of theory marks			
			R Level	U Level	A Level	Total Marks
1.	Anatomy and physiology of an eye	04	06	02	02	10
2.	Physical & Geometric Optics and Color theory	06	04	02	02	08
3.	Eye disease and Primary eye care	08	08	04	02	14
4.	Ophthalmic diagnostic Procedures	10	08	06	04	18
5.	Ophthalmic equipments and Ethics in Ophthalmic Practice	14	08	06	06	20
	Total	**42**	**34**	**20**	**16**	**70**

Legends: R = Remember**, U** = Understand**, A=** Apply and above Level (Bloom's revised taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

10. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

A. Collect the images of various ophthalmic instruments from internet and attach their photographs in file/journal.
B. Prepare the model/Chart related to eye.
C. Visit ophthalmology department of the hospital for demonstration of various eye equipment

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

A. Arrange Seminars/Symposiums by giving topics to students (and ask them to explore the details from Internet.)
B. Show animations/video films to explain the concepts
C. Arrange visit to an advanced eye hospital
D. Arrange expert lectures.

12. SUGGESTED PROJECT LIST

A. Human eye model
B. Low-Cost Vision Screening Kit
C. Intraocular Pressure Monitoring System
D. Eye Tracking System
E. Smart Ophthalmoscope

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1.	Essentials of Medical Physiology	K Sembulingam	Jaypee Brothers Medical Publishers
2.	Introduction to Visual Optics	Alan H. Tumadiffe	ABDO College of Education,
3.	The Ophthalmic Assistant-A Text for Allied and Associated Ophthalmic Personnel	Harold A. Stein	Elsevier

14. SOFTWARE/LEARNING WEBSITES

A. **http://www.imagequiz.co.uk/quizzes/190389021**
B. **https://enchroma.com/pages/test**
C. **https://www.medicinenet.com/cataracts/quiz.htm**
D. **https://colormax.org/color-blind-test/**
E. **https://www.eyeque.com/color-blind-test-embed/**
F. **https://resource.odmu.edu.ua/chair/download/88974/fBESSvbs_1msZFkYSjsZBA/Common%20Eye%20Diseases%20and%20their%20Management.pdf**
G. **https://www.aao.org/eye-health**
H. **https://docplayer.net/20693670-Tono-pen-avia-tonometer.html**
I. **https://www.jnjvisioncare.ae/sites/default/files/public/ae/documents/slit-lamp_examination.pdf**
J. **https://stanfordmedicine25.stanford.edu/the25/fundoscopic.html?tab=proxy**

15. PO-COMPETENCY-CO MAPPING:

Semester VI	Ophthalmic Instrumentation (Course Code:4360306)						
	POs						
Competency & Course Outcomes	**PO 1 Basic & Discipline specific knowledge**	**PO 2 Problem Analysis**	**PO 3 Design/ development of solutions**	**PO 4 Engineering Tools, Experimentation &Testing**	**PO 5 Engi. practices for society, sust. & Envir.**	**PO 6 Project Management**	**PO 7 Life-long learning**
Competency	To equip the necessary skills and knowledge to use, operate and maintain ophthalmology instruments.						
Course Outcomes CO1 Identify parts of human eye along with its functions.	3	1	-	-	-	-	-
CO2 State the properties of light and color theory.	2	-	-	1	-	-	-
CO3 Describe various types of eye diseases and primary eye care.	2	1	1	-	1	-	1
CO4 Demonstrate different type of ophthalmic instruments.	3	2	-	3	-	1	1
CO5 Classify problems related to ophthalmic instruments and maintaining procedure.	3	3	2	2	-	1	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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