GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Biomedical Engineering

Subject Code: DI04003071

Subject Name: Ophthalmic Instrumentation

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Professional Elective - II

Prerequisite:	Basic understanding of human biology, fundamental ocular anatomy, basic optics and physics, introductory electronics, and essential computer and clinical skills.
Rationale:	Subject is fundamental to understand, operate, maintain, and troubleshoot ophthalmic instruments essential for accurate diagnosis, effective clinical practice, and modern eye care technology.

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
1	Recall the structure, functions and accessory parts of the human eye.	R
2	Identify clinical conditions associated with human eye and general roles and responsibilities of ophthalmic assistant.	U
3	Explain the basic components, operating principles, and standard procedures associated with commonly used ophthalmic examination instruments.	U
4	Interpret the working principles, applications, and routine maintenance requirements of various ophthalmic instruments used in practice.	U
5	Summarize modern technological advancements, emerging tools, and contemporary innovations relevant to the field of ophthalmic instrumentation.	U

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE(V)	
2	0	4	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Anatomy and physiology of an eye**	05	15%
	1.1 Structure and function of an eye with accessory parts 1.2 Physiology of an eye: Ocular movement, Visual pathway		
2.	**Ocular Pathologies and Ophthalmic Assistant Responsibilities**	04	20%
	2.1 Common ocular disease : Refractive Errors, Cataract, Glaucoma, Conjunctivitis, Corneal ulcer, Corneal abrasion, Diabetic retinopathy, Retinal detachment, Optic atrophy 2.2 Color blindness : Classification of color blindness, Test of color blindness 2.3 Role of ophthalmic assistant		
3.	**Refraction & Vision Testing Instruments**	05	15%
	3.1 Trial set 3.2 Slit Lamp : Components, Working principle, Applications 3.3 Visual Acuity Charts		
4.	**Clinical Ophthalmic Instruments**	08	25%
	4.1 Tonometers: Types-Schiotz, Applanation, Non-contact, Working principles, Clinical applications, Care & Maintenance 4.2 Ophthalmoscopes: Direct & Indirect, Components, Working principle, Clinical applications, Care & Maintenance 4.3 Retinoscope: Streak and Spot retinoscope, Working principle, Care and Maintenance 4.4 Lensometer: Components, Working principle, Clinical applications, Care & Maintenance		
5.	**Modern Ophthalmic Instruments and Emerging Technologies**	08	25%
	5.1 Keratometer: Components, Working principle, Clinical applications, Care & Maintenance 5.2 Optical Coherence Tomography (OCT) : Light source, Scanning system, Working principle and Care & Maintenance 5.3 Phacoemulsification machine: Components, Working principle and Care & Maintenance 5.4 Recent Advances in Ophthalmic Technology : Overview of AI-based ophthalmic instruments, Smart ophthalmic devices		
	Total	**30Hrs.**	**100 %**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20 %	**50 %**	**30 %**	**--**	**--**	**--**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Essentials of Medical Physiology Sembulingam, K.; Sembulingam, Prema Jaypee Brothers Medical Publishers, 2019 ISBN: 978-9352706921
2. Text book of ophthalmology; HV nema, Nitin Nema, Jaypee Brothers Medical Publishers, ISBN: 978-93-7200-261-4
3. Ophthalmic Instruments and Equipment: A handbook on care and maintenance; V.Srinivasan & R.D. Thulasiraj, Aravind publications

(b) Open-source software and website:

a) http://www.imagequiz.co.uk/quizzes/190389021
b) https://enchroma.com/pages/test
c) https://eyeguru.org/
d) https://www.aurosiksha.org/lica/ebook/basics_chapter9?utm_source=chatgpt.com

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. hour required.
1	Identification of ocular structures from chart/anatomical model of an eye.	1	02
2	Trace the visual pathway on a wall chart/diagram.	1	02
3	Categorized various eye disease based on their symptoms.	2	04
4	Conduct a test of color vision using Ishihara color vision plates using printed or projected charts.	2	04
5	Classify the different types of color blindness using standard color vision charts and reference images.	2	04
6	Study the duties, essential skills, and communication roles of an ophthalmic assistant.	2	04
7	List out steps for visual acuity of a subject using the Snellen Eye Chart.	3	04

8	Identify an essential parts of slit lamp machine.	3	04
9	Assessing intraocular pressure using applanation tonometer method.	4	04
10	Determine intraocular pressure using non contact tonometer method.	4	04
11	Study the components, working, uses, and maintenance procedure of a direct ophthalmoscope.	4	04
12	Study the components, working, uses, and maintenance procedure of an indirect ophthalmoscope.	4	04
13	Learn the techniques of streak and spot retinoscopy and how they are used to determine the refractive status of the eye.	4	04
14	Recognize part of eyepiece, focus knob, alignment know, light source, horizontal and vertical mesurment drum, of keratometer.	5	04
15	Understand B-scan and thickness map interpretation using sample images of OCT.	5	04
16	Identify parts of phaco-emulsification machine use to treat cataract.	5	04

List of Laboratory/Learning Resources 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	1,2
2.	**Color Vision Chart:** Ishiharas colour vision chart. Standard ishiharas pseudo - isochromatic plates in booklet form. Standard key for interpretation.	4
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	6

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.	**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	09,10
6.	**Ophthalmoscope Direct:** Available with LED/Halogen light source.Magnification up to x15 from direct vision to maximum magnification. Redfree, 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	12
7.	**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	13

Suggested Project List:

The projects serve as practical learning experiences for students in the field of Biomedical engineering. These projects integrate theoretical knowledge with hands-on application, fostering competency development across various Course Outcomes (COs). Below are guidelines for designing and executing projects:

- **Project Types:**
  - It can be industry-based, internet-based, workshop-based, laboratory-based, or field-based.
  - Each project should align with specific COs and address real-world challenges.
- **CO Integration:**
  - It should encompass two or more COs.
  - Integration involves aligning Program Outcomes (PrOs), Unit Outcomes (UOs), and Assessment and Design Outcomes (ADOs).
- **Project Duration:**
  - Students are encouraged to maintain a dated work diary to document their individual contributions and sufficient engagement time for each project should be allocated by faculty during the course.
- **Seminar Presentation:**
  - Before submission, students must give a seminar presentation on their project.
  - The presentation should highlight the project's objectives, methodology, results, and relevance to industry-oriented COs.

Following are suggestive projects, and additional ones can be tailored to specific course objectives. Encourage students to explore innovative solutions and apply their engineering skills effectively.

a) Smart Eyeglasses for Low Vision
b) Head-Mounted Ophthalmic Magnifier
c) Tonometry Prototype
d) Ocular Disease Tracking App
e) IoT-Enabled Eye Drop Reminder System
f) Adjustable Ophthalmic Chair Mechanism

Suggested Activities for Students:

In addition to classroom and laboratory learning, students are encouraged to engage in co-curricular activities that enhance their understanding and practical skills. These activities can be conducted in groups and should be documented in 5-page reports. Collecting physical evidence of their work will also contribute to their portfolio, which can be valuable during placement interviews.

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

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