GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: OPHTHALMIC INSTRUMENTATION
(COURSE CODE: 3360304)

Diploma Programmes in which this course is offered	Semester in which offered
Biomedical engineering	Sixth

1. RATIONALE

Ophthalmology is the branch of medicine that deals with the anatomy, physiology and diseases of the eye. Now days in hospitals and health care industries, various advanced ophthalmic instruments are used. This course focuses on various instruments, which are used to diagnose and treat the eye, an important organ of human body.

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:

i. **Maintain ophthalmic equipment for functionality and accuracy.**

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:

i. Explain the anatomy and physiology of an eye.
ii. Select the specific ophthalmic instruments.
iii. Calibrate various ophthalmic diagnostic equipment.
iv. Identify various eye diseases and primary eye care.
v. Maintain various ophthalmic instruments.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**ESE**	**PA**	**ESE**	**PA**	
4	0	2	6	70	30	20	30	**150**

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcome (In Cognitive Domain)	Topics and Sub-topics
Unit – I Anatomy and Physiology of Eye	1a. Describe the anatomical structure of an eye. 1b. Explain different types of ocular movements of an eye at different axis. 1c. Explain simultaneous movement of an eye. 1d. Describe the visual pathway.	1.1 Gross, anatomy of coats of eye ball cornea, sclera, urea, retina, lens and vitreous chamber 1.2 Physiology of eye ball, physiology of vision, color vision, ocular movements
Unit– II Ophthalmic and Geometrical, Physiological Optics	2a. Describe nature of light. 2b. Explain optical aberrations of the eye. 2c. Explain optics of a human eye. 2d. Describe photometry, fiber optics, color theory. 2e. Describe myopia, hyperopia and astigmatism	2.1 Nature of light, laws of refraction, optical aberrations of ophthalmic glasses 2.2 Optics of the human eye and refractive error 2.3 Photometry, fiber optics, colour theory 2.4 Refractive anomalies and their cause
Unit – III Ocular Eye Disease and Primary Eye Care	3a. Differentiate the following: corneal ulcer, retinopathies, irises, retinal detachment, squint, trachoma, conjunctivitis, glaucoma, cataract 3b. Describe the features of glaucoma, cataract, conjunctivitis. 3c. Describe the causes of blindness especially in children. 3d. Describe the role of ophthalmic assistant, ophthalmic technician in primary eye care.	3.1 Common eye diseases: types of conjunctivitis, trachoma, corneal ulcer and opacities, irises, cataract, lids and lacrimal sac eye injuries, glaucoma, squint, systemic disorders, screening and prevention of blindness and visual; impairment eye emergencies, first aid treatment 3.2 Blindness in adult, children and primary care 3.3 Role of ophthalmic assistant, ophthalmic technician in primary eye care
Unit– IV Ophthalmic Diagnostic Procedures	4a. Describe visual acuity. 4b. Explain color blindness. 4c. Describe OCT in brief. 4d. Describe ERG in brief.	4.1 Visual acuity 4.2 Color vision and color blindness 4.3 Optical coherence tomography 4.4 Electrophysiology-Electroretinography

Unit	Major Learning Outcome (In Cognitive Domain)	Topics and Sub-topics
Unit – V Ophthalmic Instruments	5a. Explain function of slit lamp. 5b. Describe different filters used in slit lamp. 5c. Explain different types illumination methods of slit lamp. 5d. Explain with sketches the working of the retinoscope. 5e. Explain with sketches the working of the lensometer . 5f. Describe measurement of power of spherical lens, astigmatism lens, contact lens using lensometer. 5g. Explain with sketches the working of the ophthalmoscope. 5h. Explain tonometery . 5i. Explain with sketches the working of the fundus camera with its optical principle. 5j. Explain with sketches the working of the keratometer. 5k. Explain with sketches the working of the refractometer. 5l. Differentiate the different types of refractometers.	5.1. Refractive instruments-Trial set, slit lamp, retinoscope, lensometer 5.2. Direct and indirect ophthalmoscopy, ophthalmoscope 5.3. Tonometer- Fundus camera, Keratometer 5.4. Refractometer- Abbe refractometer, immersion refractometer, TS meter 5.5. Innovations in ophthalmic instruments

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Anatomy and Physiology of Eye	10	08	02	02	12
II	Ophthalmic and Geometrical, Physiological Optics	10	08	04	02	14
III	Ocular Eye Disease and Primary Eye Care	10	08	02	00	10
IV	Ophthalmic Diagnostic Procedures	10	04	02	04	10
V	Ophthalmic Instruments	16	10	04	10	24
	Total	**56**	**38**	**14**	**18**	**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

7. SUGGESTED EXERCISES/PRACTICALS

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.

***Note**: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*

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.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx Hours. Required
1	I	Identify various parts of an eye using human eye model.	02
2	I	Identify and rearrange the various parts of visual path way using optic nerve pathway model.	02
3	II	Perform snell's law of refraction by tracking laser rays through rectangular slab of glass.	02
4	III	Identify symptoms of common eye diseases.	02
5	IV	Perform colour vision testing.	02
6	IV	Observe the output image of an object by using optical coherence tomography.	02
7	IV	Identify and draw the characteristic curve of human electroretinogram.	02
8	V	Perform routine eye examination using trial lens set.	02
9	V	Demonstrate and identify various parts of retinoscope.	02
10	V	Measure eye's spherical refraction using refractometer.	02
11	V	Demonstrate keratometer to measure curvature of cornea.	02
12	V	Examine eye structure using direct ophthalmoscope.	02
13	V	Examine eye structure using indirect ophthalmoscope	02
14	V	Examine the fundus by using fundus camera.	02
15	V	Measure power of spherical lens using lensometer.	02
16	V	Measure power of cylindrical lens using lensometer.	02
17	V	Perform slit lamp examination to provide stereoscopic view of eye.	02
Total			**34**
Note: Perform any of the practical exercises from above list for total of minimum 28 hours depending upon the availability of resources so that skills matching with the most of the outcomes of every unit are included.			

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

i. Collect the images of various ophthalmic instruments from internet and attach their photographs in file/journal.
ii. Visit ophthalmology department of the hospital for demonstration of various eye equipment

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Title of Book	Author	Publication
1.	Human anatomy and physiology	Ross and Wilson	Elsevier,2010
2.	Introduction to Visual Optics	Alan H. Tumadiffe	ABDO College of Education, 1993
3.	Clinical Optics	A.R. Elington and H.J. Frank	Blackwell Scientific
4.	Principles and Practice of Refraction	Duke Elder	Churchill Livingstone, 1993
5.	Visual Optics and Refraction- A clinical approach	David D. Michaels	Mosby, Incorporated, 2008

B) Major Equipment/ Instrument with Broad Specifications

i. Retinoscope
ii. Optometers
iii. Lensometer
iv. Slit lamp
v. Tonometer
vi. Fundus camera
vii. Keratometer
viii. Auto refractometer

C) Software/Learning Websites

i. http://www.opthalmic.com/
ii. http://www.katalystsurgical.com/
iii. http://www.surgicalinstruments.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S.S.Malkan**, Lecturer, Department of Biomedical Engineering G.G.P.Ahmedabad
- **Prof. M.H.Dave**, Lecturer, Department of Biomedical Engineering, G.P.Gandhinagar
- **Prof. N.D.Makwana**, Lecturer, Department of Biomedical Engineering, G.P.Gandhinagar
- **Prof. A.K.Bula**, Lecturer, Department of Instrumentation and control Engineering, G.P.Gandhinagar

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Susan S. Mathew**, Associate Professor, Dept. of Electrical and Electronics Engineering.
- **Dr. Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat