

**STUDY & EVALUATION SCHEMES**  
**OF**  
**BACHELOR OF OPTOMETRY (BO)**  
**(BO - II SEMESTER)**

[Applicable w.e.f. Academic Session 2020-21]



**INTEGRAL UNIVERSITY, LUCKNOW**  
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Syllabus approved by Board of Study, Faculty Board, Academic Council, Executive Council of the Integral University, Lucknow

**INTEGRAL UNIVERSITY, LUCKNOW**  
**INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH**  
**DEPARTMENT OF PARAMEDICAL & HEALTH SCIENCES**

**STUDY & EVALUATION SCHEME**  
**BACHELOR OF OPTOMETRY (BOPTM)**  
**(w.e.f. July 2020)**

**I-Year**

**II-Semester**

S. No	Code	Name of the Subject	Periods			Credits C	Evaluation Scheme				Subject Total
			L	T	P		Sessional			Exam	
						CT	TA	Total	ESE		
1.	BO108	Ocular Anatomy	3	1	0	4	40	20	60	40	100
2.	BO109	Ocular Physiology	3	1	0	4	40	20	60	40	100
3.	BO110	Ocular Biochemistry	3	1	0	4	40	20	60	40	100
4.	BO111	Optometric Optics-I	2	1	0	3	40	20	60	40	100
5.	BO112	Medical Law & Ethics	2	1	0	3	40	20	60	40	100
6.	BO113	Nutrition and Eye	2	1	0	3	40	20	60	40	100
7.	BO114	Ocular Anatomy - Lab	0	0	2	1	40	20	60	40	100
8.	BO115	Ocular Physiology - Lab	0	0	2	1	40	20	60	40	100
9.	BO116	Ocular Biochemistry - Lab	0	0	2	1	40	20	60	40	100
10.	BO117	Optometric Optics- I- Lab	0	0	2	1	40	20	60	40	100
		<b>Total</b>	<b>15</b>	<b>06</b>	<b>08</b>	<b>25</b>	<b>400</b>	<b>200</b>	<b>600</b>	<b>400</b>	<b>1000</b>

**L:** Lecture      **T:** Tutorials      **P:** Practical      **C:** Credit      **CT:** Class Test

**TA:** Teacher Assessment      **ESE:** End Semester Examination

**Sessional Total:** Class Test + Teacher Assessment

**Subject Total:** Sessional Total + End Semester Examination (ESE)

**SUBJECT NAME: OCULAR ANATOMY**  
**SUBJECT CODE: BO108**  
**(w.e.f July 2020)**

**L T P**  
**3 1 0**

**OBJECTIVES:** At the end of the course, the student should be able to:

1. Comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the eye and adnexa.
2. Identify the microscopic structures of various tissues in the eye and correlate the structure with the functions.
3. Comprehend the basic structure and connections between the various parts of the central nervous system and the eye so as to understand the neural connections and distribution.
4. To understand the basic principles of ocular embryology.

**UNIT I- RESPIRATORY SYSTEM:**

**(10Hours)**

1. Orientation of Thoracic cage- boundaries, inlet, outlet & wall
2. Intercostal muscles - origin, insertion, nerve supply
3. Diaphragm - origin, insertion, nerve supply
4. Nose, pharynx, Larynx-- extent, walls. enumerate associated cartilages & muscles
5. Trachea- extent & brief structure, concept of Tracheobronchial tree
6. Lungs- Surfaces, borders, lobes, fissures
7. Joints of Thorax- enumerate and its type

**UNIT II – DIGESTIVE SYSTEM:**

**(10Hours)**

1. Oral cavity (boundaries), tongue - parts, enumerates muscles & papillae, salivary glands- brief enumerate & discuss in brief its opening).
2. Pharynx (extent, parts & boundaries) and Oesophagus (parts, extent, constrictions, sphincters).
3. Stomach - location, parts, surfaces, curvatures, nerve supply.
4. Small Intestine parts, difference between duodenum, jejunum & ileum, nerve supply.
5. Large intestine - parts & their features in brief.
6. Liver- location, surfaces, border, lobes, Gall bladder-location, parts & function, Pancreas -location, parts, surfaces, borders & its ducts.
7. Blood vessel and layers of GIT

**UNIT-III: Central nervous system:**

**(6 hours)**

1. Spinal cord and brain stem
2. Cerebellum
3. Cerebrum.

**UNIT-IV:****(8 hours)**

1. Orbit
2. Eye
3. Sclera
4. Cornea
5. Choroid
6. Ciliary body
7. Iris
8. Retina

**UNIT-V:****(8 hours)**

1. Aqueous humor
2. Posterior chamber
3. Lens
4. Vitreous body
5. Eyelids
6. Conjunctiva
7. Embryology

**RECOMMENDED BOOKS:**

1. Principles of Anatomy & Physiology – Tortora Gerard J
2. Chaurasia's, A Text Book of Anatomy
3. Ranganathan, T.S., A Text Book of Human Anatomy.
4. Fattana, Human Anatomy, (Description and Applied), Saunder's & C P Prism Publishers, Bangalore.
5. Ester. M. Grishcimer, Physiology & Anatomy with Practical Considerations, J.P. Lippin Cott. Philadelphia.

**SUBJECT NAME: OCULAR PHYSIOLOGY**  
**SUBJECT CODE: BO109**  
**(w.e.f July 2020)**

**L T P**  
**3 1 0**

**OBJECTIVES:** At the end of the course, the student should be able to:

- Explain the normal functioning of all structures of the eye and their interactions
- Elucidate the physiological aspects of normal growth and development of the eye
- Understand the phenomenon of vision
- List the physiological principles underlying pathogenesis and treatment of diseases of the eye

**UNIT I-** **(8 hours)**

1. Protective mechanisms in the eye: Eye lids and lacrimation, description of the globe
2. Extrinsic eye muscles, their actions and control of their movements
3. Coats of the eye ball, Cornea, Aqueous
4. humor and vitreous: Intra ocular pressure
5. Iris and pupil,
6. Crystalline lens and accommodation – presbyopia

**UNIT II-** **(8 hours)**

1. Retina – structure and functions
2. Vision – general aspects of sensation
3. Pigments of the eye and photochemistry
4. The visual stimulus, refractive errors
5. Visual acuity, Vernier acuity and principle of measurement

**UNIT III-** **(8 hours)**

1. Visual perception – Binocular vision, stereoscopic vision, optical illusions
2. Visual pathway, central and cerebral connections
3. Colour vision and colour defects. Theories and diagnostic tests
4. Introduction to electro physiology

**UNIT IV-** **(8 hours)**

1. Scotopic and Photopic vision
2. Color vision, Color mixing
3. Mechanism of accommodation
4. Retinal sensitivity and Visibility
5. Receptive stimulation and flicker

**UNIT V-** **(8 hours)**

1. Introduction of Reproductive Systems in human
2. Spermatogenesis and Oogenesis
3. Physiological functions of Male and female Reproductive Hormones.
4. Menstrual Cycle
5. Placental Hormone ( Physiological Function)

**REFERENCE BOOKS:**

1. AK Khurana, Indu Khurana: Anatomy and Physiology of Eye, Second edition, CBS Publishers, New Delhi, 2006]
2. RD Ravindran: Physiology of the eye, Arvind eye hospitals, Pondicherry, 2001.
3. PL Kaufman, A Alm: Adler's Physiology of the eye clinical application, 10th edition, Mosby, 2002

**SUBJECT NAME: OCULAR BIOCHEMISTRY**  
**SUBJECT CODE: BO110**  
**(w.e.f July 2020)**

**L T P**  
**3 1 0**

**OBJECTIVES:** At the end of the course, the student should be able to demonstrate his knowledge and understanding on

1. Structure, function and interrelationship of biomolecules and consequences of deviation from the normal
2. Integration of various aspects of metabolism and their regulatory pathways
3. Principles of various conventional and specialized laboratory
4. Investigations and instrumentation, analysis and interpretation of a given data
5. Understand metabolic processes taking place in different ocular structures.

**UNIT I- (8 hours)**

Importance of ocular biochemistry in clinical optometric practice  
Tear film- composition, lipid layer, aqueous layer, mucoid layer, functions, diagnostic tests, tear, substitutes, and recent development.

**UNIT II- (8 hours)**

Cornea, biochemical composition of epithelium, bowmans layer, stroma, descemets, endothelium, functions, corneal metabolism nutrient uptake energy, transparency, barrier mechanism, pump action, irrigating solutions, aging and other anomalies, recent developments

**UNIT III- (8 hours)**

Lens- Composition metabolism, glucose utilization, sorbitol pathways, glutathione and ascorbic acid transport, transparency, cataract formation, aging photooxidation, sugar cataract, cataract and ascorbic acid act, medical therapy and recent developments, Vitreous humour- structure, composition, functions, vitreous biochemical pathology, intraocular gels.

**UNIT IV- (8 hours)**

Retina, pigment epithelium, structure, composition, photoreceptor cells, rhodopsin, lipids renewal and inner segment.

Pigment epithelium-choroid, metabolism and function, phagocytosis, Vitamin A, retinal function and metabolism, Renal neurochemistry, monoamines, acetyl choline, gaba, amino acids, taurine, neuropeptides, Biochemical correlates of retinal diseases.

**UNIT V- (8 hours)**

Reactions of monosaccharides, disaccharides, starch

Glucose, Fructose, galactose, maltose, lactose, sucrose, starch.

Analysis of unknown sugars.

Abnormal constituents in urine, sugar, proteins, ketones, blood and bile salts.

Detection of abnormal constituents in urine.

**REFERENCE BOOKS:**

1. S. Ramakrishnan, K G Prasannan and R Rajan: Text book of Medical Biochemistry, Orient Longman, Madras, 1990
2. D R Whitehart: Biochemistry of the Eye, 2nd edition, Butterworth Heinemann, Pennsylvania, 2003.
3. S. Ramakrishnan: Essentials of biochemistry and ocular biochemistry, Annamalai University Publications, Chidambaram, India, 1992

**SUBJECT NAME: OPTOMETRIC OPTICS-I**  
**SUBJECT CODE: BO111**  
**(w.e.f July 2020)**

**L T P**  
**2 1 0**

**OBJECTIVES:** Skills/knowledge to be acquired at the end of this course: -

1. Measurement of lens power , lens centration using conventional techniques
2. Transposition of various types of lenses •Knowledge to identify different forms of lenses (equi- convex, planoconvex, periscopic, etc.)
3. Knowledge to select the tool power for grinding process.
4. Measurement of surface powers using lens measure.
5. Method of laying off the lens for glazing process.
6. Ophthalmic prism knowledge –effects, units, base-apex notation, compounding and resolving prisms.

**UNIT I-**

**(8 hours)**

1. Introduction – Light, mirror, reflection, refraction & absorption.
2. Definitions – Prisms, lenses, frames, spectacles.
3. Prisms – definition, properties, refraction through prisms units.
4. Prisms – uses of prisms. Nomenclature prisms.
5. Thickness difference and base – apex notation.
6. Sign Conventions.

**UNIT II-**

**(8 hours)**

1. Lenses – Definition, Terminology used to describe lenses.
2. Form of Lenses – Convex lenses & concave lenses
3. Refraction & image formation through convex and concave lenses.
4. Determination of focal length and dioptric power of iris.
5. Surface power and radius, refractive index values.
6. Vertex distance and vertex power.
7. Effectively and effective powers.

**UNIT III-**

**(8 hours)**

1. Lens shape, size, Types i.e. Spherical, Cylindrical, Sphero cylindrical
2. Toric surfaces and their significance, Toric lenses
3. Sturm's conoid, Neutralization of lenses
4. Spherometer and sag formula
5. Focimeter – power of lens and prisms
6. Center marking & Axis marking by focimeter.
7. Transposition, Simple and Toric,

**UNIT IV-**

**(8 hours)**

1. Prismatic effect, Centeration. Decentration, Prentice's rule.
2. Prismatic effect of sphero-cylinders and Plano cylinders.
3. Differential prismatic effects.
4. Decentration of lenses and edge thickness, Decentration examples.
5. Components and interpretation of spectacles prescription.
6. Prescription mistakes commonly made, Prismatic effect of sphero-cylindrical lenses.
7. Aberrations in Ophthalmic lenses, Tilt induced power in spectacles lenses
8. Magnification in high plus lenses, Magnification in high minus lenses

**UNIT V-****(8 hours)**

1. History of spectacles, Nomenclature and terminology
2. Classification of frames- Materials (in detail), Types and Parts of spectacle frames
3. Spectacles frames –colors, sides and joints, Spectacle frame bridge
4. Shapes of spectacle frames – advantages and disadvantages
5. Spectacle frame measurements and markings, Special purpose frames – sports, kids, reading.

**REFERENCE BOOKS:**

1. David Wilson: Practical Optical Dispensing, OTEN- DE, NSW TAFE Commission, 1999
2. C V Brooks, IM Borish: System for Ophthalmic Dispensing, Second edition, Butterworth- Heinemann, USA, 1996.
3. Jalie M: The principles of Ophthalmic Lenses, The Association of Dispensing Opticians, London, 1994.

**PREREQUISITES:** Physical Optics, Geometrical Optics



**SUBJECT NAME: MEDICAL LAW & ETHICS**  
**SUBJECT CODE: BO112**  
**(w.e.f July 2020)**

L T P  
2 1 0

**LEARNING OBJECTIVE:**

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

**UNIT I- (8 hours)**

1. Medical ethics, Definition, Goal, Scope.
2. Introduction to Code of conduct
3. Basic principles of medical ethics, Confidentiality
4. Malpractice and negligence, Rational and irrational drug therapy

**UNIT II- (8 hours)**

1. Autonomy and informed consent.
2. Right of patients Care of the terminally ill.
3. Euthanasia Organ transplantation, ethics and law.

**UNIT III- (8 hours)**

1. Medico legal aspects of medical records, Medico legal case and type.
2. Records and document related to MLC ownership of medical records.
3. Confidentiality Privilege communication, Release of medical information.
4. Unauthorized disclosure, retention of medical records, other various aspects.

**UNIT IV- (8 hours)**

1. Professional Indemnity insurance policy.
2. Development of standardized protocol to avoid near miss or sentinel events obtaining an informed consent.

**UNIT V- (8 hours)**

1. Basics of emergency care and life support skill
2. Vital signs and primary assessment, Basic emergency care, first aid and triage
3. Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods
4. One and Two rescuer CPR, Using an AED (Automated external defibrillator), Managing an emergency including moving a patient

**LEARNING OUTCOME:**

Student will abide by the rule and regulation of the medicine and have abundant knowledge on professional attitude and communication among the colleague, patients and co-parties.

**RECOMMENDED BOOKS:**

1. Kennedy I, Grubb A. Medical law. London: Butterworths; 2000.
2. Jackson E. Medical law: text, cases, and materials. Oxford University Press.
3. Recent Trends in Medical Imaging ( CT, MRI and USG)
4. Bontrager KL, Lampignano J. Bontrager's Handbook of Radiographic Positioning and Techniques-E-BOOK. Elsevier Health Sciences; 2017 Feb 10.
5. Frank ED, Long BW, Smith BJ. Merrill's Atlas of Radiographic Positioning and Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.

**SUBJECT NAME: NUTRITION AND EYE**  
**SUBJECT CODE: BO113**  
**(w.e.f July 2020)**

**L T P**  
**2 1 0**

**OBJECTIVES:** At the end of the course student would have gained the knowledge of the following: • Balanced diet. • Protein, carbohydrates, vitamins, Minerals, carotenoids and eye. • Nutrition and Ocular aging • Adverse effects of ocular nutritional supplements.

**UNIT-I: INTRODUCTION. (8 hours)**

1. History of Nutrition
2. Nutrition as a science
3. Food groups, RDA
4. Balanced diet, diet planning.
5. Assessment of nutritional status

**UNIT-II: ENERGY (8 hours)**

1. Units of energy.
2. Measurements of energy and value of food
3. Energy expenditure.
4. Total energy/calorie requirement for different age groups and diseases.
5. Satiety value
6. Energy imbalance- obesity, starvation.
7. Limitations of the daily food guide.

**UNIT-III: PROTEINS (8 hours)**

1. Sources and functions
2. Essential and non- essential amino- acids.
3. Incomplete and complete proteins
4. Supplementary foods.
5. PEM and theeye
6. Nitrogen balance
7. Changes in protein requirement.

**UNIT-VI: FATS & MINERALS (8 hours)**

1. Sources and functions
2. Essential fatty acids
3. Excess and deficiency
4. Lipids and the eye.
5. Hyperlipidemia, heart diseases, atherosclerosis.
6. Minerals
7. General functions and sources
8. Macro and micro minerals associated with the eye.
9. Deficiencies and excess –ophthalmic complications (e.g. iron, calcium, iodine etc.)

**UNIT-V: VITAMINS (8 hours)**

1. General functions, and food sources
2. Vitamin deficiencies and associated eye disorders with particular emphasis to Vitamin A
3. Promoting sound habits in pregnancy, lactation and infancy.
4. Nutrient with antioxidant.
5. Properties
6. Digestion of Proteins, carbohydrates & lipids

**REFERENCE BOOKS:**

1. M Swaminathan: Hand book of Food and Nutrition, fifth edition, Bangalore printing & publishing Co.Ltd, Bangalore, 2004.
2. C Gopalan, BV Rama Sastri, SC Balasubramanian: Nutritive Value of Indian Foods, National Institute of Nutrition, ICMR, Hyderabad,2004.
3. Frank Eperjesi & Stephen Beatty: Nutrition and the Eye A practical Approach, Elsevier Butterworth- Heinemann, USA, 2006

**SUBJECT NAME: OCULAR ANATOMY- LAB**  
**SUBJECT CODE: BO114**  
**(w.e.f July 2020)**

**L T P**  
**0 0 2**

**CONTENTS:**

1. Sternum
2. Ribs
3. Vertebrae
4. Demonstration of Lungs
5. Demonstration of Chest X-ray.
6. Lumbar vertebrae
7. Stomach
8. Liver, Gall bladder and Pancreas
9. Intestine
10. Dissection of Bull's of Eye
11. Demonstration of Orbital Structure

**RECOMMENDED BOOKS:**

1. Principles of Anatomy & Physiology – Tortora Gerard J
2. Chaurasia's, A Text Book of Anatomy
3. Ranganathan, T.S., A Text Book of Human Anatomy.
4. Fattana, Human Anatomy, (Description and Applied), Saunder's & C P Prism Publishers, Bangalore.
5. Ester. M. Grishcimer, Physiology & Anatomy with Practical Considerations, J.P. Lippin Cott. Philadelphia.

**SUBJECT NAME: OCULAR PHYSIOLOGY- LAB**  
**SUBJECT CODE: BO115**  
**(w.e.f July 2020)**

**L T P**  
**0 0 2**

**CONTENTS:**

1. Lid movements
2. Tests for lacrimation tests
3. Extra ocular movements
4. Break up time
5. Pupillary reflexes
6. Applanation tonometry
7. Schiottz tonometry.
8. Measurement of accommodation and convergence
9. Visual acuity measurement.
10. Direct ophthalmoscopy
11. Indirect ophthalmoscopy
12. Retinoscopy
13. Light and dark adaptation.
14. Binocular vision( Stereopsis)

**RECOMMENDED BOOKS:**

1. AK Khurana, Indu Khurana: Anatomy and Physiology of Eye, Second edition, CBS Publishers, New Delhi, 2006.
2. RD Ravindran: Physiology of the eye, Arvind eye hospitals, Pondicherry, 2001
3. PL Kaufman, A Alm: Adler's Physiology of the eye clinical application, 10th edition, Mosby, 2002

**SUBJECTS NAME: OCULAR BIOCHEMISTRY- LAB**

**SUBJECT CODE: BO116**

**(w.e.f July 2020)**

**L T P**  
**0 0 2**

**CONTENTS:**

1. Quantitative analysis
2. Abnormal constituents in urine, sugar proteins, ketones, blood and bile salts.
3. Techniques of detection of abnormal constituents of urine:
4. Electrophoresis
  - Chromatography
  - Preparation of normal, molar and percentage solutions.
  - Preparation of buffers, pH determination
5. Demonstration
  - Estimation of blood cholesterol
  - Estimation of alkaline phosphatase.
  - Salivary amylase (effect of ph, etc)
  - Milk analysis.

**BOOKS RECOMMENDED:**

1. Fundamentals of Biochemistry-by Dr. Deb Jyoti Das,
2. Biochemistry-by-Dr Satyanarayan
3. Textbook of Medical Biochemistry -Chatterje and Shinde

**SUBJECTS NAME: OPTOMETRIC OPTICS- I LAB**  
**SUBJECT CODE: BO117**  
**(w.e.f July 2020)**

**L T P**  
**0 0 2**

**CONTENTS:**

1. Prescription laboratory in action.
2. Instruments for making lenses
3. Outline of lens surfacing and polishing
4. Recording and ordering of Ophthalmic lenses
5. Terminology used in Lens workshops
6. Ophthalmic raw material – history and general outline.
7. Manufacturing of Ophthalmic blanks – Glass
8. Glass lenses – material types and characteristics
9. Glass working –spherical surfaces
10. Glass working – Toric and Aspherical
11. ISI Standards for lenses
12. Ophthalmic lens designs – best form lenses
13. Design of high powered lenses
14. Bifocal design and manufacture
15. Faults in lenses – description
16. Faults in lenses – detection

**BOOKS RECOMMENDED:**

1. Jalie M: The principles of Ophthalmic Lenses, The Association of Dispensing Opticians, London, 1994.
2. David Wilson: Practical Optical Dispensing, OTEN- DE, NSW TAFE Commission,1999.
3. C V Brooks, IM Borish: System for Ophthalmic Dispensing, Second edition, Butterworth- Heinemann, USA, 1996.