

**Jawaharlal Institute of Postgraduate Medical
Education & Research
(JIPMER)
Puducherry**



Bachelor of Optometry

CURRICULUM

2021

This curriculum was approved at the 16th meeting of the Standing Academic Committee held on September 21, 2021 and will be applicable for students joining Bachelor of Optometry from the academic year 2021-22. The curriculum document was prepared based on the model curricula for allied health sciences courses issued by the Ministry of Health and Family Welfare, Government of India.

TABLE OF CONTENTS

Sl. No.	TITLE	Page No.
1	About JIPMER and Department of Ophthalmology	3
2	Course details	4
3	Syllabus	9
4	Course and Examination regulations	47
5	Model question papers	51

About JIPMER

Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry (JIPMER) under Government of India since the year 1956, is one of the leading Medical Institutions of India. Spread over a sprawling 195-acre campus in an urban locale of Puducherry (formerly Pondicherry), JIPMER is 170 km by road from Chennai.

JIPMER has been declared as an “Institution of National Importance” by an Act of Parliament, JIPMER, Puducherry, Act, 2008. A copy of the Act was Gazette notified on 14-7-2008 to enforce this Act. Prior to this, the Institute was functioning under the administrative control of Directorate General of Health Services, Ministry of Health and Family Welfare, New Delhi. The Institution is now empowered to award Medical Degrees under the clauses 23 & 24 of the said Act. Such Degrees shall be deemed to be included in the schedules to the respective Acts governing Medical Council of India/National Medical Commission, Indian Nursing Council, and Dental Council of India, entitling the holders to the same privileges as those attached to the equivalent awards from the recognized Universities of India.

JIPMER imparts Undergraduate (UG), Postgraduate (PG) and Super Specialty Medical Training through a large hospital complex (JIPMER Hospital) and a Nursing College. Some of the courses offered are MBBS, BSc, MSc, MD, MS, DM, and MCh courses. Full-time Ph.D. programs are available in several disciplines.

About the Department of Ophthalmology

The Department of Ophthalmology started functioning from the time of inception of JIPMER. In 1984, the department was named as “Upgraded Department of Ophthalmology” and specialty clinics like retina clinic, cornea and glaucoma clinic were established. The department was the first among government hospitals in South India to procure and start phacoemulsification surgeries in 1996. Presently there are 7 faculty comprising three professors, one Additional and 3 Assistant Professors. They are assisted by a senior refractionist, two optometrists, orthoptist and an ophthalmic assistant. At any time there are 25-30 residents doing postgraduation (MS Ophthalmology) and 4-6 senior residents in the department. The Department also runs Bachelor’s in optometry course since 2014. The Department functions with a vision to provide comprehensive, high-quality, and state-of-the-art eye care, structured training for undergraduates and postgraduates and carrying out clinical research.

COURSE DETAILS

Nomenclature: Bachelor of Optometry (B.Optom)

Background of the profession

Statement of Philosophy– Why this profession holds so much importance.

An estimated 456 million people of India's population of 1.12 billion people require vision correction (spectacles, contact lenses or refractive surgery) to be able to see and function for learning, work and life in general. Twenty-six million people are blind or vision impaired due to eye disease. A further 133 million people, including 11 million children, are blind or vision impaired simply from lack of an eye examination and an appropriate pair of glasses (uncorrected refractive error). Blindness and vision impairment place a significant economic burden on families, communities, and society at large – due to lost productivity, as well as the cost of education and rehabilitation.

About 85% of all vision impairment and 75% of blindness globally could be avoided, prevented or cured if the appropriately trained personnel and care facilities existed. The World Health Organisation (WHO) and the International Agency for the Prevention of Blindness (IAPB) launched the global initiative VISION 2020: the Right to Sight to eliminate avoidable blindness and vision impairment.

Uncorrected refractive error is the major cause of avoidable vision impairment, and the second most common cause of blindness. “Without appropriate optical correction, millions of children are losing educational opportunities and adults are excluded from productive working lives, with severe economic and social consequences. Individuals and families are pushed into a cycle of deepening poverty because of their inability to see”.

In 2007, an estimated 456 million people of India's population of 1.12 billion people required vision correction (spectacles, contact lenses or surgery) to be able to see and function for learning, work and general life activities. This included 37 million children younger than 16 years of age. Almost all of these 456 million adults and children would have normal vision if they had access to an eye examination and an appropriate pair of spectacles. However, lack of access has left 133 million of them, including 11 million children, blind or vision impaired from uncorrected refractive error. The burden of avoidable blindness and vision impairment on the health care system in India is significant, with India currently having the highest number of blind people in the world. The direct and indirect cost, including lost productivity, due to uncorrected refractive error in India has been estimated at \$23 billion per year (\$269 billion globally). As the population ages, future demand for eye care services will increase substantially. Enhancing access to these services will require an increase in the number of eye care professionals, as well as more efficient utilisation of existing professionals.

Optometry is recognized by the World Health Organization (WHO) as an independent profession through its ongoing official relations with the World Council of Optometry (WCO)

– the international optometric organization which represents almost 300,000 optometrists from 87 member organizations in 47 countries.

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.

About Optometry

Optometry means a health care profession that is autonomous and concerned especially with examining the eye for defects and faults of refraction, with prescribing correctional lenses or eye exercises, with diagnosing diseases of the eye, and with treating such diseases or referring them for treatment.

Optometry as a profession has the primary public health responsibility for eliminating uncorrected refractive error (the leading cause of vision impairment globally). As primary eye care practitioners, optometrists have a vital role in detecting potentially serious eye diseases such as cataract, glaucoma and age-related maculopathy, as well as general health conditions such as hypertension and diabetes, which means optometrists can also help alleviate the burden of other causes of blindness through diagnosis, 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 overview:

Bachelor of Optometry is a four-year course with three-year academic program divided into three phases of one year each and one-year compulsory internship period.

First phase: one year

In addition to the subjects of foundation course, Anatomy, and Physiology, students will learn in detail the ocular anatomy & physiology and introductory concepts of Optometry.

Second phase: one year

In the Second phase, the students will learn in detail about the visual optics and clinical examination of the visual system and ocular disease & also optometric instruments. They will also be trained in geometric, physical, dispensing and optometric optics

Third phase: one year

In the third phase students will be trained in Binocular Vision & Paediatric Optometry and Systemic Diseases & Public Health Optometry, contact lens and Low Vision Care, Geriatric Optometry & Occupational Optometry

Internship: one year

Internship of one year is compulsory. The interns will be given hands-on training in optics, optometry. Students will be trained to deliver independently under supervision of Ophthalmologist and optometrist.

The aims of the recommended curriculum are to produce Optometrist who are -

- Technically and clinically competent;
- Understand the theoretical basis for evidence based practice;
- Independently competent in vision care as defined;
- Effective members of the multidisciplinary team;
- Prepared to participate in or initiate research into practice;

Learning Objectives:

At the completion of this course, the student should be –

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 and dispense contact lenses for refractive correction and other ocular conditions
4. To be able to assess the low vision and provide comprehensive low vision care
5. To impart training 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 occupation and match it to the visual capabilities
8. Have knowledge and skill to conduct surveys 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

Expectation from the future graduates in the providing patient care.

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.

Available postgraduate programmes in India

- Master of Optometry (M. Optom)
- Master of Philosophy in Optometry (M Phil - Optom)
- PhD

Eligibility for the course:

- The Applicant should be an **Indian National**.
- He/she should have completed **17 years** at the time of application cut-off date.
- There is **no upper age limit**.

The applicants should have passed the qualifying examinations in the manner mentioned below:

- The Higher / Senior Secondary Examination or the Indian School Certificate Examination which is equivalent to 10+2 Higher/Senior Secondary Examination after a period of 12 years study, the last two years of such study comprising Physics, Chemistry, Biology/ Botany & Zoology (which shall include practical tests in these subjects) and with English as a subject.
- The applicant must have passed in the subjects of Physics, Chemistry, Biology/Botany & Zoology and English individually and must have obtained a minimum of 50% marks taken together in Physics, Chemistry, Biology/Botany & Zoology at the qualifying examination
- Candidates belonging to the Scheduled Castes/Scheduled Tribe or Other Backward Classes must have obtained a minimum of 40% marks in the subjects of Physics, Chemistry, Biology / Botany & Zoology taken together in the qualifying examination.
- For PwD candidates in general and EWS categories, the minimum marks in Physics, Chemistry, Biology/ Botany & Zoology taken together in the qualifying examination is 45%.

Candidates intake per year:

Five candidates will be admitted to the course every year. There is no provision for sponsored / nominated candidates.

Duration of the course

4 years (48 months) duration including 3 years of classes and one year of compulsory internship.

Medium of instruction:

English

Vacation:

Students will be eligible for 4 weeks of vacation in summer and 2 weeks in winter.

Subject details:

Phase	Paper	Title of the paper
I	I	Foundation course (T & P)
	II	Anatomy and Physiology (T & P)
	III	Pathology and Microbiology (T)
	IV	Applied Basic sciences in Ophthalmology and Biochemistry (T & P)
II	I	Visual optics & Clinical examination of visual system (CEVS) and Ocular Disease & Optometric Instruments (T & P)
	II	Geometric Optics & Physical Optics (T & P)
	III	Dispensing Optics & Optometric Optics (T & P)
III	I	Binocular Vision & Paediatric Optometry and Systemic Diseases & Public Health Optometry (T & P)
	II	Contact Lens (T & P)
	III	Low Vision Care, Geriatric Optometry & Occupational Optometry (T & P)
IV	Internship period	

T- Theory, P- Practical

Teaching hours:

Phase	Subject	Theory	Practical	Others
I	Foundation course	80	40	
	Anatomy	60	180	
	Physiology	60	180	
	Pathology	40		
	Microbiology	40		
	Applied Basic sciences in Ophthalmology	30	280	
	Biochemistry	30		
	Self-study/Library			60
Total				1080
II	Visual optics & Clinical examination of visual system (CEVS) and Ocular Disease & Optometric Instruments	60	280	
	Geometric Optics & Physical Optics	60	280	
	Dispensing Optics & Optometric Optics	60	280	
	Self-study/Library			60
Total				1080
III	Binocular Vision & Paediatric Optometry and Systemic Diseases & Public Health Optometry	60	280	
	Contact Lens	60	280	
	Low Vision Care, Geriatric Optometry & Occupational Optometry	60	280	
	Self-study/Library			60
Total				1080
IV	Internship			

SYLLABUS

Phase I

Paper I: Foundation course

Theory:

Introduction to National Healthcare System

The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world. Topics to be covered under the subject are as follows:

1. Introduction to healthcare delivery system
 - a. Healthcare delivery system in India at primary, secondary and tertiary care
 - b. Community participation in healthcare delivery system
 - c. Health system in developed countries.
 - d. Private Sector
 - e. National Health Mission
 - f. National Health Policy
 - g. Issues in Health Care Delivery System in India
2. National Health Programme- Background objectives, action plan, targets, operations, achievements, and constraints in various National Health Programme.
3. Introduction to AYUSH system of medicine
 - a. Introduction to Ayurveda.
 - b. Yoga and Naturopathy
 - c. Unani
 - d. Siddha
 - e. Homeopathy
 - f. Need for integration of various system of medicine
4. Health scenario of India- past, present, and future
5. Demography & Vital Statistics-
 - a. Demography – its concept
 - b. Vital events of life & its impact on demography
 - c. Significance and recording of vital statistics
 - d. Census & its impact on health policy
6. Epidemiology
 - a. Principles of Epidemiology
 - b. Natural History of disease
 - c. Methods of Epidemiological studies

d. Epidemiology of communicable & non-communicable diseases, disease transmission, host defence immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Medical terminologies and record keeping

This course introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes. Topics include origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests.²⁵ Topics to be covered under the subject are as follows:

1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic medical terms.
5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
6. Interpret basic medical abbreviations/symbols.
7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.
8. Interpret medical orders/reports.
9. Data entry and management on electronic health record system.

Basic computers and information science

The students will be able to appreciate the role of computer technology. The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation. Topics to be covered under the subject are as follows:

1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
2. Input output devices: Input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices (monitors, pointers, plotters, screen image projector, voice response systems).
3. Processor and memory: The Central Processing Unit (CPU), main memory.
4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing, and maximizing, etc.).
6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.
7. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
8. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
9. Introduction of Operating System: introduction, operating system concepts, types of operating system.
10. Computer networks: introduction, types of networks (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
11. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
12. Application of Computers in clinical settings.

Medical law and ethics

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.²⁶

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analysing, and attempting to resolve the ethical problems that arise in practice".²⁶ Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum. Few of the important and relevant topics that need to focus on are as follows:

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
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia

7. Organ transplantation
8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
9. Professional Indemnity insurance policy
10. Development of standardized protocol to avoid near miss or sentinel events
11. Obtaining an informed consent.

Communication and soft skills

Major topics to be covered under Communication course –

1. Basic Language Skills: Grammar and Usage.
2. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
3. Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization.
4. Basic concepts & principles of good communication
5. Special characteristics of health communication
6. Types & process of communication
7. Barriers of communication & how to overcome

Introduction to Quality and patient safety

1. Quality assurance and management - The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system.
 - a. Concepts of Quality of Care
 - b. Quality Improvement Approaches
 - c. Standards and Norms
 - d. Quality Improvement Tools
 - e. Introduction to NABH guidelines
2. Basics of emergency care and life support skills - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED). Initial recognition and response to heart attack and stroke are also

considered part of BLS. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows:

- a. Vital signs and primary assessment
- b. Basic emergency care – first aid and triage
- c. Ventilations including use of bag-valve-masks (BVMs)
- d. Choking, rescue breathing methods
- e. One- and Two-rescuer CPR
- f. Using an AED (Automated external defibrillator).
- g. Managing an emergency including moving a patient

At the end of this topic, focus should be to teach the students to perform the manoeuvres in simulation lab and to test their skills with focus on airways management and chest compressions. At the end of the foundation course, each student should be able to perform and execute/operate on the above-mentioned modalities.

3. Bio medical waste management and environment safety- The aim of this section will be to help prevent harm to workers, property, the environment, and the general public. Topics to be covered under the subject are as follows:

- a. Definition of Biomedical Waste
- b. Waste minimization
- c. BMW – Segregation, collection, transportation, treatment, and disposal (including colour coding)
- d. Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste
- e. BMW Management & methods of disinfection
- f. Modern technology for handling BMW
- g. Use of Personal protective equipment (PPE)
- h. Monitoring & controlling of cross infection (Protective devices)

4. Infection prevention and control - The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include –

- a. Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)],
- b. Prevention & control of common healthcare associated infections,
- c. Components of an effective infection control program, and
- d. Guidelines (NABH and JCI) for Hospital Infection Control

5. Antibiotic Resistance-

- a. History of Antibiotics
- b. How Resistance Happens and Spreads
- c. Types of resistance- Intrinsic, Acquired, Passive
- d. Trends in Drug Resistance
- e. Actions to Fight Resistance
- f. Bacterial persistence
- g. Antibiotic sensitivity
- h. Consequences of antibiotic resistance
- i. Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals

6. Disaster preparedness and management- The objective of this section will be to provide knowledge on the principles of on-site disaster management. Concepts to be taught should include-

- a. Fundamentals of emergency management,
- b. Psychological impact management,
- c. Resource management,
- d. Preparedness and risk reduction,
- e. Key response functions (including public health, logistics and governance, recovery, rehabilitation, and reconstruction), information management, incident command and institutional mechanisms.

Professionalism and values

The module on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant professionalism in terms of healthcare system is and how it affects the overall patient environment.

1. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality
2. Personal values- ethical or moral values
3. Attitude and behaviour- professional behaviour, treating people equally
4. Code of conduct, professional accountability and responsibility, misconduct
5. Differences between professions and importance of team efforts
6. Cultural issues in the healthcare environment

Research Methodology and Biostatistics

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.

1. Introduction to research methods
2. Identifying research problem
3. Ethical issues in research
4. Research design
5. Basic Concepts of Biostatistics
6. Types of Data
7. Research tools and Data collection methods
8. Sampling methods
9. Developing a research proposal

Principles of Management

The course is intended to provide a knowledge about the basic principles of Management.

1. Introduction to management
2. Strategic Management
3. Foundations of Planning
4. Planning Tools and Techniques
5. Decision Making, conflict and stress management
6. Managing Change and Innovation
7. Understanding Groups and Teams
8. Leadership
9. Time Management
10. Cost and efficiency

Community orientation and clinical visit

The objective of this section of the foundation course is to sensitize potential learners with essential knowledge; this will lay a sound foundation for their learning across the undergraduate program and across their career. Innovative teaching methods should be used to ensure the attention of a student and make them more receptive such as group activities, interactive fora, role plays, and clinical bed-side demonstrations.

1. The community orientation and clinical visit will include visit to the entire chain of healthcare delivery system -Sub centre, PHC, CHC, SDH, DH and Medical College, private hospitals, dispensaries, and clinics.
2. The student will also be briefed regarding governance at village level including interaction and group discussion with village panchayat and front-line health workers.
3. Clinical visit to their respective professional department within the hospital.

Practical:

Fundamentals of computers

1. Learning to use MS office: MS word, MS PowerPoint, MS Excel
2. To install different software.
3. Data entry efficiency

Paper II: Anatomy and Physiology

Gross anatomy and Histology

Theory:

General Anatomy:

Introduction – Anatomical terms, position, movements; epithelium – classification, structure & examples; Tissues – classification and structure; skin – structure, thick and thin skin; cartilage – types, structure, hyaline, elastic, and white fibrocartilage; bones – classification, structure, growth; muscles - classification & structure; glands - classification & structure.

Musculoskeletal system:

Axial and appendicular skeleton – muscle groups and regions muscles with action.

Cardiovascular and lymphatic system:

Structure of pericardium, heart & major blood vessels – arteries, veins, and lymphatic system – classification and structure of lymphoid organs – thymus, spleen, lymph node, tonsil, and major lymphatic vessels.

Respiratory system:

Parts of respiratory system, structure of external nose, paranasal air sinuses, nasal cavity, nasopharynx, larynx, trachea, pleura, lungs & diaphragm.

Gastrointestinal system:

Parts of gastrointestinal system, salivary glands, oral cavity, oropharynx and laryngopharynx, esophagus, stomach, small intestine, large intestine, liver, gallbladder, extrahepatic biliary apparatus, and pancreas.

Excretory system:

Parts of excretory system – structure of kidney, ureter, urinary bladder & urethra.

Male and female reproductive systems:

Structure & parts of male reproductive system, external genitalia, testis, epididymis, vasdeferens, seminal vesicle and prostate.

Structure & parts of female reproductive system, uterus, ovary, fallopian tubes, and mammary gland

Endocrine system:

Location & structure of thyroid, parathyroid, pituitary, adrenal glands.

Special senses:

Structure of eyeball, external, middle & internal ear, and papillae of tongue.

Nervous system:

Neuron, neuroglia, classification, autonomic nervous system, meninges, parts of brain,

cerebrum, cerebellum, basal nuclei, limbic system, thalamus, hypothalamus, spinal cord, circulation of cerebrospinal fluid.

Histology:

General histology:

Microscopy – Types of microscopes, parts of microscope, cleaning, and maintenance of microscope.

Microscopic features of

1. Cartilages
 - 1.1 Hyaline,
 - 1.2 Elastic
 - 1.3 White fibro cartilages
2. Bones
 - 2.1 Longitudinal section of compact bone
 - 2.2 Cross section of compact bone
3. Muscles
 - 3.1 Skeletal muscle
 - 3.2 Cardiac muscle
4. Glands
 - 4.1 Serous gland
 - 4.2 Mucous gland
 - 4.3 Mixed gland
5. Blood vessels
 - 5.1 Medium sized artery
 - 5.2 Large sized artery
 - 5.3 Medium sized vein
 - 5.4 Large sized vein
6. Nervous tissue
 - 6.1 Peripheral nerve H & E stain
 - 6.2 Peripheral nerve Osmic acid stain
 - 6.3 Dorsal root (spinal) ganglia
 - 6.4 Autonomic ganglia
7. Lymphoid organs
 - 7.1 Thymus
 - 7.2 Lymph node
 - 7.3 Spleen
 - 7.4 Tonsil
8. Skin
 - 8.1 Thick skin
 - 8.2 Thin skin

Practical: Anatomy (Gross anatomy and Histology)

1. Demonstration of bones

2. Demonstration of various parts of body
3. Demonstration of parts of digestive system
4. Demonstration of parts of respiratory system
5. Demonstration of parts of reproductive system
6. Demonstration of parts of excretory system
7. Demonstration of various parts of circulatory system
8. Demonstration of various parts of nervous system
9. General histology slides

Textbooks Recommended (Latest edition):

General anatomy:

1. Handbook of General Anatomy – B.D. Chaurasia - CBS Publishers

Systemic Anatomy:

1. Textbook of Anatomy – Vishram Singh – Elsevier
2. B.D. Chaurasia's Human Anatomy – CBS Publishers
3. Manipal Manual of Anatomy for Allied Health Science Courses

Histology:

1. Textbook of Human Histology: With Color Atlas 3D Illustrations – Dr. Yogesh Sontakke
2. Textbook of Histology - A Practical guide – Dr. J. P Gunasegaran
3. Di Fiore's Atlas of Histology – Eroschenko – Lippincott Williams & Wilkins

Reference textbook:

Gray's Anatomy: The Anatomical Basis of Clinical Practice – Susan Standring – Elsevier

Physiology

Theory:

1. General Physiology

- a. Principle of homeostasis
- b. Cell membrane, cell organelles, intercellular junctions
- c. Transport across cell membrane
- d. Body fluids: Classification of body fluid compartments, ionic composition, measurement
- e. Resting membrane potential

2. Blood

- a. Composition of blood
- b. Plasma proteins: classification and functions
- c. RBC: development, morphology, counts, functions and dysfunctions

- d. Hemoglobin: types, structure, synthesis, function, degradation, anemia
- e. WBC: development, classification, morphology, counts, functions and dysfunctions
- f. Immunity: definition, classification, Innate, Cellular and Humoral Immunity
- g. Platelets: morphology, counts, development, functions and dysfunctions
- h. Blood coagulation: clotting factors, mechanism, dysfunctions
- i. Anticoagulants
- j. Blood grouping: classification, cross matching, blood transfusion, Rh factor and incompatibility

3. Nerve

- a. Structure, function, classification of neurons
- b. Neuronal action potential: ionic basis and properties
- c. Conduction of nerve impulses
- d. Nerve Injuries
- e. Neuromuscular junction: structure, mechanism of transmission & applied aspects

4. Muscle

- a. Structure of skeletal muscle & sarcomere system
- b. Mechanism of contraction and relaxation of skeletal muscle
- c. Isotonic and isometric contraction
- d. Properties of skeletal muscle
- e. Smooth muscle: structure, properties, and mechanism of contraction
- f. Differences between skeletal, smooth, and cardiac muscles

5. Autonomic nervous system

- a. Divisions and functions

6. Gastrointestinal (GI) system

- a. Functional anatomy of GIT
- b. Gastrointestinal hormones
- c. Principles & Functions of GI secretions, applied aspects
- d. Movements of GIT, applied aspects

7. Endocrine system

Hormones, actions, and dysfunctions of various endocrine glands:

- a. Hypothalamus
- b. Pituitary
- c. Thyroid
- d. Parathyroid and hormones involved in calcium homeostasis
- e. Adrenal gland
- f. Endocrine pancreas

8. Reproductive System

- a. Male and female gametogenesis
- b. Structure and function of male reproductive system
- c. Structure of female reproductive system, menstrual cycle, pregnancy, parturition, lactation
- d. Contraceptives

9. Kidney

- a. Structure & function of kidney, structure of nephron, composition of urine
- b. Glomerular filtration rate: definition, values, regulation and measurement
- c. Mechanism of urine formation: tubular functions, concentration of urine, acidification of urine
- d. Micturition reflex
- e. Diuretics
- f. Dialysis

10. Cardiovascular system

- a. Functional anatomy of heart
- b. Circulatory system: arterial, venous, capillary circulation
- c. Structure and properties of cardiac muscle
- d. Electrophysiology of heart and conduction of impulse
- e. ECG: waveforms and physiological basis
- f. Cardiac cycle, heart sounds, Jugular venous pulse
- g. Stroke volume, heart rate, cardiac output – definition, normal values and their regulation
- h. Blood pressure and regulation
- i. Coronary circulation
- j. Lymphatic circulation
- k. Applied aspects: shock, hypertension, hypotension, tachycardia, bradycardia, heart failure

11. Respiratory system

- a. Functional anatomy of respiratory system
- b. Mechanics of breathing, lung volumes and capacities, compliance, surfactant
- c. Alveolar ventilation, dead space, pulmonary circulation, ventilation-perfusion ratio
- d. Diffusion and gas exchange
- e. Transport of oxygen and carbon dioxide
- f. Brief account of respiratory regulation
- g. Acclimatization, definition & types of hypoxia, oxygen therapy, cyanosis, asphyxia.
- h. Methods of artificial respiration

12. Central nervous system

- a. Parts and functions of brain and spinal cord
- b. Sensory system: receptors and ascending pathways
- c. Motor system: motor neurons, motor units, muscle spindle, stretch reflex, and descending tracts with emphasis on corticospinal tract
- d. Cerebellum- functional anatomy, functions, and dysfunctions
- e. Basal ganglia- functional anatomy, functions, and dysfunctions
- f. Functions of hypothalamus
- g. Functions of Thalamus
- h. Types of sleep and EEG

- i. Cerebrospinal fluid
- j. Higher functions: types of memory, centers of speech, types of aphasia in brief, Cerebral cortex-lobes and functions
- k. Blood-brain barrier

13. Special senses

- a. Vision: Components of visual apparatus, visual acuity, color vision, accommodation, errors of refraction, visual pathway, pupillary reflexes
- b. Hearing: External, middle ear, inner ear and their functions, auditory pathway, hearing tests.
- c. Taste – receptors and pathway
- d. smell: receptors and pathway

14. Integrative Physiology

- a. Structure and functions of skin
- b. Regulation of temperature

Practical: Physiology

1. Hematology

- a. Methods of collection of blood
- b. Microscopy
- c. Haemocytometry
- d. Total RBC count
- e. Estimation of haemoglobin
- f. Calculation of blood indices
- g. Demonstration of osmotic fragility of red blood cells
- h. Determination of ESR
- i. Total leucocyte count
- j. Absolute eosinophil count
- k. Peripheral blood smear
- l. Differential leukocyte count
- m. Arneht count
- n. Determination of blood group
- o. Bleeding time, Clotting time
- p. Demonstration of reticulocyte count
- q. Demonstration of platelet count
- r. Demonstration of PCV

2. Clinical

- a. General physical examination
- b. Clinical examination of Radial pulse
- c. Determination of blood pressure
- d. Recording of Electrocardiogram
- e. Examination of cardiovascular system

- f. Examination of respiratory system
- g. Demonstration of spirometry
- h. Determination of vital capacity and effect of posture of vital capacity
- i. Examination of sensory system
- j. Examination of motor system
- k. Visual acuity
- l. Color vision
- m. Pupillary reflexes
- n. Perimetry
- o. Tests of hearing
- p. Mosso's ergography

Textbooks recommended: (Latest edition)

- 1. Textbook of Medical Physiology by G.K. Pal (Theory)
- 2. Textbook of Practical Physiology by G.K. Pal & Pravati Pal (Practical)

Teaching learning methodology:

The course content in Physiology will be covered by:

- 1. Interactive Lectures
- 2. Group Discussions
- 3. Practical classes & demonstrations
- 4. Seminars
- 5. Assignments

Paper III: Pathology and Microbiology

Pathology

The Pathology syllabus introduces the principles of **Pathology** with emphasis on applied aspects of Pathology particularly in the following areas:

1. Collection and dispatch of specimens for routine pathological investigations
2. Common routine pathology tests
3. General concepts of Pathology
4. Laboratory diagnosis of common pathological conditions
5. Systemic Pathology
6. Applied Surgical Pathology, cytopathology, hematopathology, renal pathology and neuropathology

Theory:

1. Adaptations, cell injury and repair

- a. Hyperplasia,
- b. hypertrophy,
- c. atrophy,
- d. metaplasia,
- e. Necrosis and
- f. Apoptosis

2. Acute and chronic inflammation

- a. Cardinal signs of inflammation
- b. Outcomes of acute inflammation
- c. Chronic inflammation
- d. Granulomatous inflammation
- e. Acute phase proteins

3. Tissue repair, regeneration, and hemodynamic disorders

- a. Cutaneous wound healing
- b. Pathological aspects of repair
- c. Hyperaemia and congestion
- d. Thrombosis and Virchow triad
- e. Embolism, infarction, and shock

4. Disorders of immune system

- a. Types of hypersensitivity reactions
- b. Autoimmune diseases

5. Neoplasia

- a. Definition of neoplasia.
- b. Differences between benign and malignant tumours
- c. Metastasis
- d. Carcinogenesis – causes

6. Applied general pathology related to transfusion medicine

- a. ABO blood group & Rh system (terminologies)
- b. Principles of blood grouping and cross matching
- c. Shelf life of stored blood
- d. Anticoagulants used for storing blood and temperature for storage

7. RBC, WBC, and bleeding disorders

- a. Anaemia – definition and classification
- b. Iron deficiency anaemia and haemolytic anaemia
- c. Leukocytosis and leukaemia
- d. Causes of splenomegaly
- e. Thrombocytopenia and coagulation disorders
- f. Phlebotomy, haemoglobin estimation, peripheral smear examination, bleeding time, PT and APTT

8. Disorders of GI tract, liver, biliary tract, and pancreas

- a. Causes of peptic ulcer, carcinoma stomach, intestinal obstruction, acute appendicitis, and colonic carcinoma
- b. Jaundice – classification based on pathophysiology
- c. Cirrhosis – definition and causes
- d. Hepatitis – types and mode of transmission
- e. Portal hypertension and hepatic failure

9. Blood vessels, heart, and lung diseases

- a. Risk factors for atherosclerosis and their classification
- b. Hypertension – definition and causes
- c. Varicose veins, thrombophlebitis and phlebothrombosis
- d. Congenital heart disease and heart failure
- e. Myocardial infarction and cor-pulmonale
- f. Rheumatic heart disease
- g. Chronic obstructive airway disease
- h. Asthma, pneumonia, and lung carcinoma

10. The kidney and lower urinary tract, male and female genital tract

- a. Acute and chronic renal failure
- b. Nephrotic and nephritis syndrome
- c. Acute tubular necrosis and urolithiasis
- d. Carcinoma penis, testicular tumours, and prostatic hyperplasia
- e. Endometriosis, adenomyosis and leiomyoma

11. Endocrine and nervous system

- a. Diagnostic criteria, types, and complications of diabetic mellitus
- b. Intracerebral, subarachnoid, and subdural haemorrhage
- c. Meningitis and encephalitis

- d. Epilepsy and CNS tumours

12. Applied Surgical Pathology & Cytopathology, renal pathology, and neuropathology

- a. Histopathology techniques
- b. Fine needle aspiration cytology and imprint cytology
- c. Basic terminologies of surgical specimens
- d. Urine analysis and renal biopsy
- e. CSF cytology, nerve and muscle biopsy, squash cytology

Textbooks recommended (latest edition):

1. Illustrated Pathology – McFarlen
2. Essentials of Rubin's Pathology
3. Basic Pathology by Robbins
4. General and systemic Pathology – Underwood and Cross

Teaching and Learning methodology

Mostly will be didactic lectures with tutorials.

Microbiology

The Microbiology syllabus introduces the principles of **Microbiology** with emphasis on applied aspects of Microbiology of infectious diseases particularly in the following areas

1. Universal and Standard precaution.
2. Collection and dispatch of specimens for routine microbiological investigations.
3. Common routine serological tests
4. General concept of infection
5. Common Bacteriological, Viral, Fungal, Parasitic infection and Laboratory diagnosis
6. Nosocomial infection
7. Biomedical waste management
8. Vaccine

Theory:

Introduction and Morphology

Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.

Growth and Nutrition

Nutrition, Culture media, Types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test.

Sterilisation and Disinfection

Principles and use of equipment of sterilization namely Hot Air oven, Autoclave and serum inspissator. Pasteurization, Anti septic and disinfectants.

Immunology

Immunity, Types of Immunity, Vaccines, Types of Vaccine and immunization schedule. Principles and interpretation of commonly done serological tests namely Widal, VDRL, ASLO, ELISA, Rapid tests for HIV and HbsAg

Systematic Bacteriology

Morphology, diseases caused, laboratory diagnosis including specimen collection of the following bacteria (the classification, antigenic structure and pathogenicity are not to be taught) Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci, C. diphtheriae, Mycobacterium tuberculosis, Clostridium spp., Bacillus spp., Shigella spp., Salmonella spp., Escherichia coli, Klebsiella spp., Proteus spp., Vibrio cholera, Pseudomonas spp. & Spirochaetes

Parasitology

Morphology, life cycle, laboratory diagnosis of following parasites E. histolytica, Plasmodium spp., Tapeworms, Intestinal nematodes, Filariasis

Mycology

Morphology, diseases caused, laboratory diagnosis of following fungi. Candida, Cryptococcus, opportunistic fungi

Virology

General properties of viruses, diseases caused, lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Rabies and Poliomyelitis

Hospital Infection

Causative agents, transmission methods, investigation, prevention and control Hospital infection, Universal precaution, Standard precaution

Principles And Practice Biomedical Waste Management

Applied Microbiology

Causative agents, Sample collection and Laboratory diagnosis

Gastrointestinal infections, Nosocomial infections, Urinary tract infections, Respiratory tract infections, Pyogenic Meningitis, Food borne infections, Vector borne infections, Blood borne infections, Aerosol borne infections.

Textbooks recommended (latest editions):

1. CP. Baveja. Textbook of Microbiology for nurses. Arya Publishing Company.
2. RL Ichhpujani, Rajesh Bhatia. Essentials of Medical Microbiology. Jaypee Brothers Medical Pub (p) Ltd.
3. Seema Sood. Microbiology for Nursing Students & Nurses. Elsevier India Pvt.Ltd.
4. Satish Gupte. Short Textbook of Medical Microbiology. Jaypee Brothers Medical Pub (p) Ltd.
5. CK Jayaram Paniker, Ananthanarayan R. Textbook of Microbiology for nurses. Publisher Universities Press (India) Limited.
6. B.S.Nagoba. Clinical Microbiology. Bi Publications Pvt Ltd.
7. Clint E Carter, Burton J Bogitsh, Thomas N Oeltmann. Human Parasitology. Publisher Elsevier India Pvt. Ltd.

Paper IV: Applied Basic sciences in Ophthalmology and Biochemistry

Section A: Students will learn about ocular anatomy, ocular physiology, ocular biochemistry and basic and ocular pharmacology

Ocular Anatomy

Ocular anatomy deals with detailed anatomy of the orbit, eyeball and cranial nerves associated with ocular functions.

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.

Theory:

1. Central nervous system:
 - 1.1 Spinal cord and brain stem
 - 1.2 Cerebellum
 - 1.3 Cerebrum.
2. Orbit
 - 2.1 Eye
 - 2.2 Sclera
 - 2.3 Cornea
 - 2.4 Choroid
 - 2.5 Ciliary body
 - 2.6 Iris
 - 2.7 Retina
3. Refractory media-
 - 3.1 Aqueous humor
 - 3.2 Anterior chamber
 - 3.3 Posterior chamber
 - 3.4 Lens
 - 3.5 Vitreous body
4. Eyelids
5. Conjunctiva
6. Embryology

Practical (Total: 15 hours)

1. Eye & Orbit: Practical demonstration of orbital structures.

Ocular Physiology

Ocular physiology deals with the physiological functions of each part of eye.

The student should be able to:

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

Theory:

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
4. Cornea
5. Aqueous humor and vitreous: Intra ocular pressure
6. Iris and pupil
7. Crystalline lens and accommodation – presbyopia
8. Retina – structure and functions
9. Vision – general aspects of sensation
10. Pigments of the eye and photochemistry
11. The visual stimulus, refractive errors
12. Visual acuity, Vernier acuity and principle of measurement
13. Visual perception – Binocular vision, stereoscopic vision, optical illusions
14. Visual pathway, central and cerebral connections
15. Colour vision and colour defects. Theories and diagnostic tests
16. Introduction to electro physiology
17. Scotopic and Photopic vision
18. Color vision, Color mixing
19. Mechanism of accommodation
20. Retinal sensitivity and Visibility
21. Receptive stimulation and flicker
22. Ocular, movements and saccades
23. Visual perception and adaptation
24. Introduction to visual psychology (Psychophysics)

Practical:

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. Ophthalmoscopy – Direct and Indirect ophthalmoscopy
11. Retinoscopy
12. Light and dark adaptation.
13. Binocular vision(Stereopsis)

Ocular Biochemistry:

Ocular Biochemistry deals with the metabolism that takes place in the human body. It also deals with ocular biochemistry in detail.

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 investigations and instrumentation, analysis and interpretation of a given data
4. Understand metabolic processes taking place in different ocular structures.

Theory:

1. Hormones basic concepts in metabolic regulation with examples say insulin.
2. Metabolism: General whole body metabolism (carbohydrates, proteins, lipids)
3. Ocular Biochemistry: Various aspects of the eye, viz., cornea, lens aqueous, vitreous, retina and pigment rhodopsin. (The important chemicals in each and their roles.)
Immunology of anterior segment
4. Technique: Colloidal state, sol. Gel. Emulsion, dialysis, electrophoresis. pH buffers mode of action, molar and percentage solutions, photometer, colorimeter and spectrometry.
Radio isotopes: application in medicine and basic research.
5. Clinical Biochemistry: Blood sugar, urea, creatinine and bilirubin significance of their estimation.

Ocular Microbiology

1. To prepare the students to gain essential knowledge about the characteristics of bacteria, viruses, fungi and parasites;
2. To acquire knowledge of the principles of sterilisation and disinfection in hospital and ophthalmic practice;
3. To understand the pathogenesis of the diseases caused by the organisms in the human body with particular reference to the eye infections and

4. To understand basic principles of diagnostic ocular Microbiology.

Theory:

1. Morphology and principles of cultivating bacteria
2. Sterilization and disinfections used in laboratory and hospital practice
3. Common bacterial infections of the eye.
4. Common fungal infections of the eye
5. Common viral infections of the eye.
6. Common parasitic infections of the eye.

Basic and Ocular Pharmacology

Basic and ocular pharmacology covers the actions, uses, adverse effects and mode of administration of drugs, especially related to eyes.

The students will acquire knowledge in the following aspects-

1. Basic principle of pharmacokinetics & Pharmacodynamics
2. Commonly used ocular drugs, mechanism, indications, contraindications, drug dosage and adverse effects.

Theory:

3. General Pharmacology:
 - Introduction & sources of drugs, Routes of drug administration,
 - Pharmacokinetics (emphasis on ocular pharmacokinetics), Pharmacodynamics & factors modifying drug actions
4. Systemic Pharmacology:
 - Autonomic nervous system: Drugs affecting papillary size and light reflex, Intraocular tension, Accommodation;
 - Cardiovascular system: Anti- hypertensive sand drugs useful in Angina;
 - Diuretics: Drugs used in ocular disorders;
 - Central Nervous System: Alcohol, sedative hypnotics, General & local anaesthetics, Opioids & non-opioids;
 - Chemotherapy : Introduction on general chemotherapy, Specific chemotherapy
 - Antiviral, antifungal, antibiotics;
 - Hormones : Corticosteroids, Antidiabetics; Blood Coagulants
5. Ocular Pharmacology:

- Ocular preparations, formulations and requirements of an ideal agent
- Ocular Pharmacokinetics, methods of drug administration & Special drug delivery system; Ocular Toxicology

6. Diagnostic & Therapeutic applications of drugs used in Ophthalmology:

- Diagnostic Drugs & biological agents used in ocular surgery
- Anaesthetics used in ophthalmic procedures,
- Anti-glaucoma drugs;
- Pharmacotherapy of ocular infections –Bacterial, viral, fungal & chlamydial;
- Drugs used in allergic, inflammatory & degenerative conditions of the eye;
- Immune modulators in Ophthalmic practice,
- Wetting agents & tear substitutes
- Antioxidants

Section B: General Biochemistry

- Carbohydrate chemistry: Monosaccharides, Disaccharides and Polysaccharides in health and disease
- Lipid chemistry: Simple, compound, and derived lipids, Lipoproteins in health and disease
- Protein chemistry: Amino acids, protein structure, protein denaturation
- Enzymes: Coenzymes, classification, Types of enzyme inhibition, Factors affecting enzyme activity; Clinical enzymology
- Nucleic acid chemistry: DNA, RNA
- Vitamins: Dietary sources, recommended dietary allowance, functions, and deficiency / toxicity of Vitamins
- Minerals: Dietary sources, recommended dietary allowance, functions, and deficiency / toxicity of Minerals
- Nutrition: basal metabolic rate, Protein Energy Malnutrition, Obesity, Food adulterants / additives
- Diabetes and Oral glucose tolerance test: Diagnosis and complications of diabetes,
- Renal and liver disease: RFT, LFT
- Myocardial infarction and Lipid profile: Cardiac markers

Text/Reference Books (Latest edition): General Biochemistry

1. Textbook of Biochemistry by Vasudevan and Sreekumari
2. Medical laboratory Procedure Manual (T-M) by K.L. Mukerjee 1987, Vol.I, II & III Tata McGraw Hill Publication.
3. Textbook of Medical Biochemistry by Ramakrishna
4. Textbook of Clinical chemistry by Norbert Teitz.
5. Principles and Techniques of Practical Biochemistry by Wilson and Walker.

Paper I: Visual optics & Clinical examination of visual system (CEVS) and Ocular Diseases & Optometric Instruments (T & P)

Visual Optics:

Visual optics deals with the concept of eye as an optical instrument and thereby covers various optical components of eye, types of refractive errors, clinical approach in diagnosis and management of various types of refractive errors.

The student should be able:

1. To understand the fundamentals of optical components of the eye
2. To gain theoretical knowledge and practical skill on visual acuity measurement, objective and subjective clinical refraction.

Theory:

1. Review of Geometrical Optics: Vergence and power
 - 1.1 Conjugacy, object space and image space
 - 1.2 Sign convention
 - 1.3 Spherical refracting surface
 - 1.4 Spherical mirror; catoptric power
 - 1.5 Cardinal points
 - 1.6 Magnification
 - 1.7 Light and visual function
 - 1.8 Clinical Relevance of: Fluorescence, Interference, Diffraction, Polarization, Bi-refringence, Dichroism
 - 1.9 Aberration and application Spherical and Chromatic
2. Optics of Ocular Structure
 - 2.1 Cornea and aqueous
 - 2.2 Crystalline lens
 - 2.3 Vitreous
 - 2.4 Schematic and reduced eye
3. Measurements of Optical Constants of the Eye
 1. 3.1 Corneal curvature and thickness
 2. 3.2 Keratometry
 3. 3.3 Curvature of the lens and ophthalmophakometry
 4. 3.4 Axial and axis of the eye
 5. 3.5 Basic Aspects of Vision.
 1. 3.5.1 Visual Acuity
 2. 3.5.2 Light and Dark Adaptation
 3. 3.5.3 Color Vision
 4. 3.5.4 Spatial and Temporal Resolution

5. 3.5.5 Science of Measuring visual performance and application to Clinical Optometry
4. Refractive anomalies and their causes
 1. 4.1 Etiology of refractive anomalies
 2. 4.2 Contributing variability and their ranges
 3. 4.3 Populating distributions of anomalies.
 4. 4.4 Optical component measurements
 5. 4.5 Growth of the eye in relation to refractive errors

Ocular Diseases

Ocular diseases subject deals with various ocular diseases affecting various parts of the eyes. It covers clinical signs and symptoms, cause, pathophysiological mechanism, diagnostic approach, differential diagnosis and management aspects of the ocular diseases.

The students will be knowledgeable in the following aspects of ocular diseases:

1. Etiology
2. Epidemiology
3. Symptoms
4. Signs
5. Course sequelae of ocular disease
6. Diagnostic approach and
7. Management of the ocular diseases.

Theory:

1. Orbit

- a. Applied Anatomy
- b. Proptosis(Classification,Causes,Investigations)
- c. Enophthalmos
- d. Developmental Anomalies (craniosynostosis, Craniofacial Dysostosis, Hypertelorism, Median facial cleft syndrome)
- e. Orbital Inflammations (Preseptal cellulites, Orbital cellulitis Orbital Periostitis, cavernous sinus Thrombosis)
- f. Grave's Ophthalmopathy
- g. Orbital tumors(Dermoids, capillary haemangioma, Optic nerve glioma)
- h. Orbital blowout fractures
- i. Orbital surgery (Orbitotomy)
- j. Orbital tumors
- k. Orbital trauma
- l. Approach to a patient with proptosis

2. Lids

- a. Applied Anatomy
- b. Congenital anomalies (Ptosis, Coloboma, Epicanthus, Distichiasis, Cryptophthalmos)
- c. Oedema of the eyelids(Inflammatory, Solid, Passive edema)
- d. Inflammatory disorders (Blepharitis, External Hordeolum, Chalazion, Internal hordeolum, Molluscum Contagiosum)
- e. Anomalies in the position of the lashes and Lid Margin (Trichiasis, Ectropion, Entropion, Symblepharon, Blepharophimosis, Lagophthalmos, Blepharospasm, Ptosis).
- f. Tumors (Papillomas, Xanthelasma, Haemangioma, Basal carcinoma, Squamous cell carcinoma, sebaceous gland melanoma)

3. Lacrimal System

- a. Applied Anatomy
- b. Tear Film
- c. The Dry Eye (Sjogren's Syndrome)
- d. The watering eye (Etiology, clinical evaluation)
- e. Dacryocystitis
- f. Swelling of the Lacrimal gland(Dacryoadenitis)

4. Conjunctiva

- a. Applied Anatomy
- b. Inflammations of conjunctiva (Infective conjunctivitis – bacterial, chlamydial, viral , Allergic conjunctivitis, Granulomatous conjunctivitis)
- c. Degenerative conditions(Pinguecula, Pterygium, Concretions)
- d. Symptomatic conditions(Hyperaemia, Chemosis, Ecchymosis, Xerosis, Discoloration)
- e. Cysts and Tumors

5. Cornea

- a. Applied Anatomy and Physiology
- b. Congenital Anomalies (Megalocornea, Microcornea, Cornea plana, Congenital cloudy cornea)
- c. Inflammations of the cornea (Topographical classifications: Ulcerative keratitis and Non ulcerative)
- d. Etiological classifications: Infective, Allergic, Trophic, Traumatic, Idiopathic))
- e. Degenerations (classifications, Arcussenilis, Vogt's white limbal girdle, Hassal-henle bodies, Lipoid Keratopathy, Band shaped keratopathy, Salzmann's nodular degeneration, Droplet keratopathy, Pellucid Marginal degeneration)

- f. Dystrophies (Reis Buckler dystrophy, Recurrent corneal erosion syndrome, Granular dystrophy, Lattice dystrophy, Macular dystrophy, cornea guttata, Fuch's epithelial endothelial dystrophy, Congenital hereditary endothelial dystrophy)
- g. Keratoconus, Keratoglobus
- h. Corneal oedema, Corneal opacity, Corneal vascularisation
- i. Penetrating Keratoplasty

6. Uveal Tract and Sclera

- a. Applied Anatomy,
- b. Classification of uveitis
- c. Etiology
- d. Pathology
- e. Anterior Uveitis
- f. Posterior Uveitis
- g. Purulent Uveitis
- h. Endophthalmitis
- i. Panophthalmitis
- j. Pars Planitis
- k. Tumors of uveal tract(Melanoma)
- l. Episcleritis and scleritis
- m. Clinical examination of Uveitis and Scleritis

7. Retina and Vitreous:

- a. • Applied Anatomy
- b. • Congenital and Developmental Disorders (Optic Disc: Coloboma, Drusen,
- c. Hypoplasia, Medullated nerve fibers; Persistent Hyaloid Artery)
- d. • Inflammatory disorders (Retinitis : Acute purulent , Bacterial, Virus, mycotic)
- e. • Retinal Vasculitis (Eales's)
- f. • Retinal Artery Occlusion (Central retinal Artery occlusion)
- g. • Retinal Vein occlusion (Ischaemic, Non Ischaemic , Branch retinal vein
- h. occlusion)
- i. • Retinal degenerations : Retinitis Pigmentosa, Lattice degenerations
- j. • Macular disorders: Solar retinopathy, central serous retinopathy, cystoid macular
- k. edema, Age related macular degeneration.
- l. • Retinal Detachment: Rhegmatogenous, Tractional, Exudative)
- m. • Retinoblastoma
- n. • Diabetic retinopathy

Ocular Injuries:

- a. Terminology : Closed globe injury (contusion, lamellar laceration) Open globe injury (rupture, laceration, penetrating injury, perforating injury)
- b. Mechanical injuries (Extraocular foreign body, blunt trauma, perforating injury, sympathetic ophthalmitis)
- c. Non Mechanical Injuries (Chemical injuries, Thermal, Electrical, Radiational)
- d. Clinical approach towards ocular injury patients

Lens

- a. Applied Anatomy and Physiology
- b. Clinical examination
- c. Classification of cataract
- d. Congenital and Developmental cataract
- e. Acquired (Senile, Traumatic, Complicated, Metabolic, Electric, Radiational, Toxic)
- f. Morphological: Capsular, Subcapsular, Cortical, Supranuclear, Nuclear, Polar.
- g. Management of cataract (Non-surgical and surgical measures; preoperative evaluation, Types of surgeries,)
- h. Complications of cataract surgery
- i. Displacement of lens: Subluxation, Displacement
- j. Lens coloboma, Lenticonus, Microspherophakia.

Clinical Neuro-ophthalmology

Anatomy of visual pathway

Lesions of the visual pathway

- a. Pupillary reflexes and abnormalities (Amaurotic light reflex, Efferent pathway defect, Wernicke's hemianopic pupil, Marcus gunn pupil. Argyll Robertson pupil, Adie's tonic pupil)
- b. Optic neuritis, Anterior Ischemic optic neuropathy, Pappilloedema, optic atrophy
- c. Cortical blindness
- d. Malingering
- e. Nystagmus
- f. Clinical examination
- g. Glaucoma
- h. Applied anatomy and physiology of anterior segment
- i. Clinical Examination
- j. Definitions and classification of glaucoma
- k. Pathogenesis of glaucomatous ocular damage
- l. Congenital glaucoma's

- m. Primary open angle glaucoma
- n. Ocular hypertension
- o. Normal Tension Glaucoma
- p. Primary angle closure glaucoma (Primary angle closure suspect, Intermittent
- q. glaucoma, acute congestive, chronic angle closure)
- r. Secondary Glaucoma's
- s. Management: common medications, laser intervention and surgical techniques

Clinical examination of the visual system

Clinical examination of the visual system covers various clinical optometry procedures involving external examination, anterior segment and posterior segment examination, neuroophthalmic examination, paediatric optometry examination, and Glaucoma evaluation.

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. History taking
2. Visual acuity estimation
3. Extraocular motility, Cover test, Alternating cover test
4. Hirschberg test, Modified Krimsky
5. Pupils Examination
6. Maddox Rod
7. Van Herrick
8. External examination of the eye, Lid Eversion
9. Schirmer's, TBUT, tear meniscus level, NITBUT (keratometer),
10. Color Vision
11. Stereopsis
12. Confrontation test
13. Photostress test
14. Slit lamp biomicroscopy
15. Ophthalmoscopy
16. Tonometry
17. ROPLAS
18. Amsler test
19. Contrast sensitivity function test
20. Saccades and pursuit test

Optometric Instruments

This subject covers commonly used optometric instruments, its basic principle, description and usage in clinical practice.

The student should be able to gain theoretical knowledge and basic practical skill in handling the following instruments

1. Visual Acuity chart/drum
2. Retinoscope
3. Trail Box
4. Jackson Cross cylinder
5. Direct ophthalmoscope
6. Slit lamp Biomicroscope
7. Slit lamp Ophthalmoscopy (+90, 78 D)
8. Gonioscope
9. Tonometer: Applanation Tonometer
10. Keratometer
11. Perimeter
12. Electrodiagnostic instrument (ERG, VEP, EOG)
13. A –Scan Ultrasound
14. Lensometer

Theory:

1. Refractive instruments
 1. Optotypes and MTF, Spatial Frequency
 2. Test charts standards.
 3. Choice of test charts
 4. Trial case lenses
 5. Refractor (phoropter) head units
 6. Optical considerations of refractor units
 7. Trial frame design
 8. Near vision difficulties with units and trial frames
 9. Retinoscope – types available
 10. Adjustment of Retinoscopes- special features
 11. Objective optometers.
 12. Infrared optometer devices.
 13. Projection charts
 14. Illumination of the consulting room.
 15. Brightness acuity test
 16. Vision analyzer
 17. Pupilometer
 18. Potential Acuity Meter
 19. Abberometer

2. Ophthalmoscopes and related devices
 1. Design of ophthalmoscopes – illumination
 2. Design of ophthalmoscopes- viewing
 3. Ophthalmoscope disc
 4. Filters for ophthalmoscopy
 5. Indirect ophthalmoscope

3. Lensometer, Lens gauges or clock
4. Slit lamp
5. Tonometers
6. Keratometer and corneal topography
7. Refractometer
8. Orthoptic Instruments (Synaptophore Only)
9. Color Vision Testing Devices
10. Fields of Vision And Screening Devices
11. Scans
12. ERG

Paper II: Geometric optics & Physical optics (T & P)

Geometrical optics:

Geometric Optics is the study of light and its behaviour as it propagates in a variety of media. Specifically, the phenomena of reflection and refraction of light at boundaries between media and subsequent image formation will be dealt with in detail. Reflections at plane and spherical surfaces and refractions at plane, spherical, cylindrical and toric surfaces will be studied in this course. Attention will be given to the system of surfaces and/or lenses and their imaging properties. The effect of aperture stops on the quality of images, such as blur and aberrations, depth of field and depth of focus, will also be studied

OBJECTIVES: The objective of this course is to equip the students with a thorough knowledge of mirrors and lenses. 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. Vergence and vergence techniques revised.
2. Gullstrand's schematic eyes, visual acuity, Stile Crawford
3. Emmetropia and ametropia
4. Blur retinal Imaginary
5. Correction of spherical ametropia, vertex distance and effective power, dioptric power of the spectacle, to calculate the dioptric power, angular magnification of spectacles in aphakic
6. Thin lens model of the eye – angular magnification – spectacle and relative spectacle magnification.
7. Aperture stops- entrance and exit pupils.
8. Astigmatism. - To calculate the position of the line image in a sphero-cylindrical lens.
9. Accommodation – Accommodation formulae and calculations.
10. Presbyopia- Spectacle magnification, angular magnification of spectacle lens, near point, calculation of add, depth of field.
11. Spatial distribution of optical information- modulation transfer functions- Spatial filtering- applications.
12. Visual optics of aphakia and pseudophakia.

Practical:

1. Construction of a tabletop telescope – all three types of telescopes.
2. Construction of a tabletop microscope
3. Imaging by a cylindrical lens – relationship between cylinder axis and image orientation
4. Imaging by two cylinders in contact – determination of the position of CLC; verification of CLC using a spherical lens with power equal to the spherical equivalent; orientations and position of the line images and their relation to the cylinders' powers and orientations
5. Imaging by a spherocylindrical lens – sphere and cylinder in contact – determination of the position of CLC; verification of CLC using a spherical lens with power equal to the

spherical equivalent; orientations and position of the line images and their relation to the cylinder's power and orientation

Physical Optics

Physical Optics is the study of light, its properties and its interaction with matter. Specifically, the phenomena of interference, diffraction, polarization and scattering will be dealt with in detail.

Students will be able to predict the distribution of light under various conditions.

Theory:

1. Nature of light –light as electromagnetic oscillation –wave equation; ideas of sinusoidal oscillations –simple harmonic oscillation; transverse nature of oscillation; concepts of frequency, wavelength, amplitude and phase.
2. Sources of light; Electromagnetic Spectrum.
3. Polarized light; linearly polarized light; and circularly polarized light.
4. Intensity of polarized light; Malus' Law; polarizers and analyzers; Methods of producing polarized light; Brewster's angle.
5. Birefringence; ordinary and extraordinary rays.
6. Relationship between amplitude and intensity.
7. Coherence; interference; constructive interference, destructive interference; fringes; fringe width.
8. Double slits, multiple slits, gratings.
9. Diffraction; diffraction by a circular aperture; Airy's disc
10. Resolution of an instrument (telescope, for example); Raleigh's criterion
11. Scattering; Raleigh's scattering; Tyndall effect.
12. Fluorescence and Phosphorescence
13. Basics of Lasers –coherence; population inversion; spontaneous emission; Einstein's theory of lasers.
14. Radiometry; solid angle; radiometric units; photopic and scotopic luminous efficiency and efficacy curves; photometric units
15. Inverse square law of photometry; Lambert's law.
16. Other units of light measurement; retinal illumination; Trolands

Practical:

Each practical session could be evaluated for 10 marks and the total could be added to the final evaluations. These practical could be customized as per the university requirements and spaced apart conveniently. The practical to be done include the following:

1. Gratings–determination of grating constant using Sodium vapour lamp; determination of wavelengths of light from Mercury vapour lamp
2. Circular Apertures – measurements of Airy's disc for apertures of various sizes
3. Verification of Malus' Law using a polarizer – analyzer combination

4. Demonstration of birefringence using Calcite crystals
5. Measurement of the resolving power of telescopes.
6. Newton's rings
7. Demonstration of fluorescence and phosphorescence using crystals and paints

Phase II

Paper III: Dispensing optics & Optometric optics (T & P)

Students will observe the basic operations of the optometry clinic while interacting with the multidisciplinary team members involved in providing optimal care to patients.

Dispensing optics:

1. Components of spectacle prescription & interpretation, transposition, Add and near 1 power relation
2. Frame selection –based on spectacle prescription, professional requirements, age 4 group, face shape
3. Measuring Inter-pupillary distance (IPD) for distance & near, bifocal height 1
4. Lens & Frame markings, Pupillary centers, bifocal heights, Progressive markings & 1 adjustments –facial wrap, pantoscopic tilt
5. Recording and ordering of lenses (power, add, diameter, base, material, type, lens 1 enhancements)
6. Neutralization –Hand & lensometer, axis marking, prism marking 3
7. Faults in spectacles (lens fitting, frame fitting, patients complaints, description, 2 detection and correction)
8. Final checking & dispensing of spectacles to customers, counselling on wearing & 2 maintaining of spectacles, Accessories –Bands, chains, boxes, slevets, cleaners, screwdriver kit
9. Spectacle repairs –tools, methods, soldering, riveting, frame adjustments
10. Special types of spectacle frames
 - Monocles
 - Ptosis crutches
 - Industrial safety glasses
 - Welding glasses 1

Visual optics

This subject deals with the concept of eye as an optical instrument and thereby covers different optical components of eye, types of refractive errors, clinical approach in diagnosis and management of various types of refractive errors.

Objectives:

1. To understand the fundamentals of optical components of the eye
2. To gain theoretical knowledge and practical skill on visual acuity measurement, objective and subjective clinical refraction.

Accommodation & Presbyopia

1. Far and near point of accommodation
2. Range and amplitude of accommodation
3. Mechanism of accommodation
4. Variation of accommodation with age

Anomalies of accommodation

1. Presbyopia
2. Hypermetropia and accommodation
3. Convergence:
4. type, Measurement and Anomalies
5. Relationship between accommodation and convergence-AC/A ratio

Objective Refraction (Static & Dynamic)

1. Streak retinoscopy
2. Principle, Procedure, Difficulties and interpretation of findings
3. Transposition and spherical equivalent
4. Dynamic retinoscopy various methods
5. Radical retinoscopy and near retinoscopy

Cycloplegic refraction

Subjective Refraction:

1. Principle and fogging
2. Fixed astigmatic dial(Clock dial),Combination of fixed and rotator dial(Fan and block test),J.C.C
3. Duochrome test

o Binocular balancing- alternate occlusion, prism dissociation, dissociate Duochrome balance, Borish dissociated fogging

o Binocular refraction-Variou techniques

Effective Power &Magnification :

1. Ocular refraction vs. Spectacle refraction
2. Spectacle magnification vs. Relative spectacle magnification
3. Axial vs. Refractive ametropia, Knapp's law
4. Ocular accommodation vs. Spectacle accommodation

Retinal image blur-Depth of focus and depth of field

Optometric Optics

This subject deals with understanding the theory behind spectacle lenses and frames, their materials, types, advantages and disadvantages, calculations involved, when and how to prescribe. It will impart construction, design application and development of lenses, particularly of the methods of calculating their power and effect. The objectives are:

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. Ophthalmic prism knowledge – effects, units, base-apex notation, compounding and resolving prisms.
6. Knowledge of prism and decentration in ophthalmic lenses
7. Knowledge of different types of materials used to make lenses and its characteristics
8. Knowledge lens designs –single vision, bifocals, progressive lens
9. Knowledge on tinted and protective lenses
10. Knowledge on special lenses like isekonic, spectacle magnifiers.
11. Knowledge on spectacle frames –manufacture, materials
12. To select the tool power for grinding process
13. Different types of materials used to make lenses and its characteristics
14. Lens designs–Bifocals, progressive lens
15. Tinted, Protective & Special lenses
16. Spectacle frames –manufacture process & materials
17. Art and science of dispensing spectacle lens and frames based on the glass prescription.
18. Reading of spectacle prescription. Counselling the patient
19. Lens edge thickness calculation
20. Frame & lens measurements and selection
21. Writing spectacle lens order
22. Facial measurements - Interpupillary distance measurement and measuring heights (single vision, multifocal, progressives)
23. Lens verification and axis marking and fitting of all lens types
24. Final checking of finished spectacle with frame adjustments
25. Delivery and follow-up
26. Troubleshooting complaints and handling patient's questions
27. Introduction –Light, Mirror, Reflection, Refraction and Absorption
28. Prisms–Definition, properties, Refraction through prisms, Thickness difference, Base-apex notation, uses, nomenclature and units, Sign Conventions, Fresnel's prisms, rotary prisms
29. Lenses –Definition, units, terminology used to describe, form of lenses
30. Vertex distance and vertex power, Effectivity calculations
31. Lens shape, size and types i.e. Spherical, cylindrical and Sphero-cylindrical

32. Transpositions –Simple, Toric and Spherical equivalent
33. Prismatic effect, centration, decentration and Prentice rule, Prismatic effect of Plano-cylinder and Spherocylinder lenses
34. Spherometer & Sag formula, Edge thickness calculations
35. Magnification in high plus lenses, Minification in high minus lenses
36. Tilt induced power in spectacles
37. Aberration in Ophthalmic Lenses

Spectacle Lenses - II:

- Manufacture of glass
- Lens materials
- Lens surfacing
- Principle of surface generation and glass cements
- Terminology used in Lens workshop
- Lens properties
- Lens quality
- Faults in lens material
- Faults on lens surface
- Methods of Inspecting the quality of lenses
- Safety standards for ophthalmic lenses (FDA, ANSI, ISI, Others)

Spectacle Frames:

- Types and parts
- Classification of spectacle frames-material, weight, temple position, Coloration
- Frame construction
- Frame selection
- Size, shape, mounting and field of view of ophthalmic lenses

Tinted & Protective Lenses

- Characteristics of tinted lenses Absorptive Glasses
- Polarizing Filters, Photochromic & Reflecting filters
- Safety lenses-Toughened lenses, Laminated Lenses, CR 39, Polycarbonate lenses

Multifocal Lenses: 3

- Introduction, history and development, types
- Bifocal lenses, Trifocal & Progressive addition lenses

Reflection from spectacle lens surface & lens coatings:

- Reflection from spectacle lenses - ghost images -Reflections in bifocals at the dividing line
- Antireflection coating, Mirror coating, Hard Multi Coating [HMC], Hydrophobic coating

Miscellaneous Spectacle:

- Iseikonic lenses
- Spectacle magnifiers
- Recumbent prisms
- Fresnel prism and lenses
- Lenticular & Aspherical lenses
- High Refractive index glasses

Accommodation & Presbyopia

- Far and near point of accommodation
- Range and amplitude of accommodation
- Mechanism of accommodation
- Variation of accommodation with age

Anomalies of accommodation

- Presbyopia
- Hypermetropia and accommodation
- Convergence:
 - o Type, Measurement and Anomalies
 - o Relationship between accommodation and convergence-AC/A ratio

Objective Refraction (Static & Dynamic)

- Streak retinoscopy
- Principle, Procedure, Difficulties and interpretation of findings
- Transposition and spherical equivalent
- Dynamic retinoscopy various methods
- Radical retinoscopy and near retinoscopy

Cycloplegic refraction

Subjective Refraction:

- Principle and fogging
- Fixed astigmatic dial(Clock dial),Combination of fixed and rotator dial(Fan and block test),J.C.C
- Duochrome test

- o Binocular balancing- alternate occlusion, prism dissociation, dissociate Duochrome balance, Borish dissociated fogging
- o Binocular refraction-Variou techniques

Effective Power & Magnification :

- Ocular refraction vs. Spectacle refraction
- Spectacle magnification vs. Relative spectacle magnification
- Axial vs. Refractive ametropia, Knapp's law
- Ocular accommodation vs. Spectacle accommodation

Retinal image blur-Depth of focus and depth of field

Phase III

Paper I: Binocular vision & Paediatric optometry and Systemic diseases & Public Health Optometry

Binocular Vision

This subject provides theoretical aspects of Binocular Vision and its clinical application. It deals with basis of normal binocular vision and space perception, Gross anatomy and physiology of extraocular muscles, various binocular vision anomalies, its diagnostic approaches and management.

Student will be expected to be able to:

- Demonstrate an in-depth knowledge of the gross anatomy and physiology relating to the extraocular muscles.
- Provide a detailed explanation of, and differentiate between the etiology, investigation and management of binocular vision anomalies.
- Adapt skills and interpret clinical results following investigation of binocular vision anomalies appropriately and safely.

Theory:

1. Binocular Vision and Space perception.
 1. 1.1 Relative subjective visual direction.
 2. 1.2 Retino motor value
 3. 1.3 Grades of BSV
 4. 1.4 SMP and Cyclopean Eye
 5. 1.5 Correspondence,
 5. 1.6 Fusion, Diplopia, Retinal rivalry
 6. 1.7 Horopter
 7. 1.8 Physiological Diplopia and Suppression
 8. 1.9 Stereopsis, Panum's area, BSV.
 9. 1.10 Stereopsis and monocular clues - significance.
 10. 1.11 Egocentric location, clinical applications.
 11. 1.12 Theories of Binocular vision.
2. Anatomy of Extra Ocular Muscles.
 1. 2.1 Rectii and Obliques, LPS.
 2. 2.2 Innervation & Blood Supply.
3. Physiology of Ocular movements.
 1. 3.1 Center of rotation, Axes of Fick.
 2. 3.2 Action of individual muscle.
4. Laws
 1. 4.1 Donders' and Listing's law
 2. 4.2 Sherrington's law

3. 4.3 Hering's law
5. Uniocular & Binocular movements - fixation, saccadic & pursuits.
 1. 5.1 Version & Vergence.
 2. 5.2 Fixation & field of fixation
6. Near Vision Complex Accommodation
 1. 6.1 Definition and mechanism (process).
 2. 6.2 Methods of measurement.
 3. 6.3 Stimulus and innervation.
 4. 6.4 Types of accommodation.
 5. 6.5 Anomalies of accommodation – aetiology and management.
7. Convergence
 1. 7.1 Definition and mechanism.
 2. 7.2 Methods of measurement.
 3. 7.3 Types and components of convergence - Tonic, accommodative, fusional, proximal.
 4. 7.4 Anomalies of Convergence – aetiology and management of ocular motility
8. Sensory adaptations 8.1 Confusion
 1. Suppression
 - 9.1 Investigations
 1. 9.2 Management
 2. 9.3 Blind spot syndrome
10. Abnormal Retinal Correspondence
 1. 10.1 Investigation and management
 2. 10.2 Blind spot syndrome
11. Eccentric Fixation
 - 11.1 Investigation and management
12. Amblyopia
 - 12.1 Classification 12.2 Aetiology 12.3 Investigation
 - 12.4 Management

Binocular Vision II

1. Neuro-muscular anomalies
 - 1.1 Classification and etiological factors
 2. History – recording and significance.
 3. Convergent strabismus
 - 3.1 Accommodative convergent squint 3.1.1 Classification
 - 3.1.2 Investigation and Management 3.2 Non accommodative Convergent squint

3.1.3 Classification

3.1.4 Investigation and Management

4. Divergent Strabismus
 1. 4.1 Classification
 2. 4.2 A& V phenomenon
 3. 4.3 Investigation and Management
5. Vertical strabismus
 1. 5.1 Classification
 2. 5.2 Investigation and Management

6. Paralytic Strabismus

6.1 Acquired and Congenital 6.2 Clinical Characteristics

7. Distinction from comitant and restrictive Squint
8. Investigations
 1. 8.1 History and symptoms
 2. 8.2 Head Posture
 3. 8.3 Diplopia Charting
 4. 8.4 Hess chart
 5. 8.5 PBCT
 6. 8.6 Nine directions
 7. 8.7 Binocular field of vision
9. Amblyopia and Treatment of Amblyopia
10. Nystagmus
11. Non-surgical Management of Squint
12. Restrictive Strabismus
 1. 12.1 Features
 2. 12.2 Musculo-fascical anomalies
 3. 12.3 Duane's Retraction syndrome
 4. 12.4 Clinical features and management
 5. 12.5 Brown's Superior oblique sheath syndrome
 6. 12.6 Strabismusfixus
 7. 12.7 Congenital muscle fibrosis
13. Surgical management

Practical: Deals with hand-on session the basic binocular vision evaluation techniques.

Pediatric Optometry

This is designed to provide the students adequate knowledge in theoretical and practical aspects of diagnosis, and management of eye conditions related to paediatric population. Also it will inculcate the skill of transferring / communicating the medical information to the attender / patient by the students. The scope of this subject is to train the optometrists to develop a systematic way of dealing with children below 12, to implement primary eye care and have better, specialized management of anomalies.

At the end of the course the student is expected to:

1. Have a knowledge of the principal theories of childhood development, and visual development
2. Have the ability to take a thorough paediatric history which encompasses the relevant developmental, visual, medical and educational issues
3. Be familiar with the accommodative-vergence system, the genesis of ametropia, the disorders of refraction, accommodation and vergence, and the assessment and management of these disorders
4. Be familiar with the aetiology, clinical presentation and treatment of amblyopia, comitant strabismus and commonly presenting incomitant strabismus
5. Have a knowledge of the epidemiology of eye disease in children, the assessment techniques available for examining visual function of children of all ages and an understanding of management concepts of paediatric vision disorders
6. Have a knowledge of the art of dispensing contact lenses, low vision aids and referral to the surgeon or other specialists at the appropriate timing.
7. Have a capacity for highly evolved communication and co-management with other professionals involved in paediatric assessment and care
8. professional involvement in paediatric assessment and care

Theory:

1. The Development of Eye and Vision
2. History taking Paediatric subjects
3. Assessment of visual acuity
4. Normal appearance, pathology and structural anomalies of
 1. 4.1 Orbit, Eye lids, Lacrimal system,
 2. 4.2 Conjunctiva, Cornea, Sclera Anterior chamber, Uveal tract, Pupil
 3. 4.3 Lens, vitreous, Fundus Oculomotor system
5. Refractive Examination
6. Determining binocular status
7. Determining sensory motor adaptability
8. Compensatory treatment and remedial therapy for : Myopia, Pseudomyopia, Hyperopia, Astigmatism, Anisometropia, Amblyopia
9. Remedial and Compensatory treatment of Strabismus and Nystagmus
10. Paediatric eye disorders : Cataract, Retinopathy of Prematurity, Retinoblastoma, Neuromuscular conditions (myotonic dystrophy, mitochondrial cytopathy), and Genetics
11. Anterior segment dysgenesis, Aniridia, Microphthalmos, Coloboma, Albinism
12. Spectacle dispensing for children
13. Paediatric contact lenses
14. Low vision assessment in children

Systemic diseases

This deals with definition, classification, clinical diagnosis, complications and management of various systemic diseases. In indicated cases ocular manifestations also will be discussed.

Students should get acquainted with the following:

1. Common Systemic conditions: Definition, diagnostic approach, complications and management options
2. Ocular findings of the systemic conditions
3. First Aid knowledge

Theory:

1. Hypertension
 1. 1.1 Definition, classification, Epidemiology, clinical examination, complications, and management.
 2. 1.2 Hypertensive retinopathy
2. Diabetes Mellitus
 1. 2.1 Classification, pathophysiology, clinical presentations, diagnosis, and management, Complications
 2. 2.2 Diabetic Retinopathy
3. Thyroid Disease
 1. 3.1 Physiology, testing for thyroid disease, Hyperthyroidism, Hypothyroidism, Thyroiditis, Thyroid tumors
 2. 3.2 Grave's Ophthalmopathy
4. Acquired Heart Disease
 1. 4.1 Ischemic Heart Disease, Congestive heart failure, Disorders of cardiac rhythm
 2. 4.2 Ophthalmic considerations
5. Cancer :
 1. 5.1 Incidence
 2. 5.2 Etiology
 3. 5.3 Therapy
 4. 5.4 Ophthalmologic considerations
6. Connective Tissue Disease
 1. 6.1 Rheumatic arthritis
 2. 6.2 Systemic lupus erythematosus
 3. 6.3 Scleroderma
 4. 6.4 Polymyositis and dermatomyositis
 5. 6.5 Sjogren syndrome
 6. 6.6 Behcet's syndrome
 7. 6.7 Eye and connective tissue disease

7. Tuberculosis
 - 7.1 Aetiology, pathology, clinical features, pulmonary tuberculosis, diagnosis, complications, treatment tuberculosis and the eye.
8. Herpes virus (Herpes simplex, Varicella Zoster, Cytomegalovirus, Epstein Barr Virus) 8.1 Herpes and the eye
9. Hepatitis (Hepatitis A, B, C)
10. Acquired Immunodeficiency Syndrome
11. Anemia (Diagnosis, clinical evaluation, consequences, Sickle cell disease, treatment, Ophthalmologic considerations)
12. Common Tropical Medical Ailments
 - 12.1 Malaria
 - 12.2 Typhoid
 - 12.3 Dengue
 - 12.4 Filariases
 - 12.5 Onchocerciasis
 - 12.6 Cysticercosis
 - 12.7 Leprosy
13. Nutritional and Metabolic disorders:
 - 13.1 Obesity
 - 13.2 Hyperlipidaemias
 - 13.3 Kwashiorkor
 - 13.4 Vitamin A Deficiency
 - 13.5 Vitamin D Deficiency
 - 13.6 Vitamin E Deficiency
 - 13.7 Vitamin K Deficiency
 - 13.8 Vitamin B1,B2, Deficiency
 - 13.9 Vitamin C Deficiency
14. Myasthenia Gravis
15. First Aid
16. General Medical Emergencies
17. Preoperative precautions in ocular surgeries
18. Psychiatry
 - 18.1 Basic knowledge of psychiatric condition and Patient Management
19. 17. Genetics
 - 19.1 Introduction to genetics
 - 19.2 Organisation of the cell
 - 19.3 Chromosome structure and cell division
 - 19.4 Gene structure and basic principles of Genetics.
 - 19.5 Genetic disorders and their diagnosis.
 - 19.6 Genes and the eye
 - 19.7 Genetic counselling and genetic engineering.

Paper II: Contact lens

Students will improve their skills in clinical procedures, and then progressive interactions with patients and professional personal are monitored as students practice optometry in supervised setting. Additional area includes problem solving and complications of various managements will be inculcated. Students should have exposure to eye bank facilities and must be made aware of eye donation, collection of eyes, preservation, pre and post-operative instructions and latest techniques for preservation of donor cornea. The students will get clinical training on the practical aspects of the following courses namely optometric optic –II & dispensing optics, visual optics – II and ocular disease -II.

The student should be able to:

1. Understand the basics of contact lenses
2. List the important properties of contact lenses
3. Finalise the CL design for various kinds patients
4. Recognize various types of fitting
5. Explain all the procedures to patient
6. Identify and manage the adverse effects of contact lens

Theory:

1. Introduction to Contact lenses

- 1.1 Definition
- 1.2 Classification / Types

2. History of Contact Lenses
3. Optics of Contact Lenses
 1. 3.1 Magnification & Visual field
 2. 3.2 Accommodation & Convergence
 3. 3.3 Back & Front Vertex Power / Vertex distance calculation
4. Review of Anatomy & Physiology of
 1. 4.1 Tear film
 2. 4.2 Cornea
 3. 4.3 Lids & Conjunctiva
5. Introduction to CL materials
 1. 5.1 Monomers, Polymers
6. Properties of CL materials
 1. 6.1 Physiological (Dk, Ionicity, Water content)
 2. 6.2 Physical (Elasticity, Tensile strength, Rigidity)
 3. 6.3 Optical (Transmission, Refractive index)
7. Indications and contraindications
8. Parameters / Designs of Contact Lenses & Terminology

9. RGP Contact Lens materials
10. Manufacturing Rigid and Soft Contact Lenses – various methods
11. Pre-Fitting examination – steps, significance, recording of results
12. Correction of Astigmatism with RGP lens
13. Types of fit – Steep, Flat, Optimum – on spherical cornea with spherical lenses
14. Types of fit – Steep, Flat, Optimum – on Toric cornea with spherical lenses
15. Calculation and finalising Contact lens parameters
16. Ordering Rigid Contact Lenses – writing a prescription to the Laboratory
17. Checking and verifying Contact lenses from Laboratory
18. Modifications possible with Rigid lenses
19. Common Handling Instructions
 1. 19.1 Insertion & Removal Techniques
 2. 19.2 Do's and Dont's
20. Care and Maintenance of Rigid lenses
 1. 20.1 Cleaning agents & Importance
 2. 20.2 Rinsing agents & Importance
 3. 20.3 Disinfecting agents & importance
 4. 20.4 Lubricating & Enzymatic cleaners
21. Follow up visit examination
22. Complications of RGP lenses

Practical:

1. Measurement of Ocular dimensions
2. Pupillary diameter and lid characteristics
3. Blink rate and TBUT
4. Schrimers test, Slit lamp examination of tear layer
5. Keratometry
6. Placido's disc
7. Soft Contact Lens fitting – Aspherical
8. Soft Contact Lens fitting – Lathecut lenses
9. Soft Contact Lens over refraction
10. Lens insertion and removal
11. Lens handling and cleaning
12. Examination of old soft Lens
13. RGP Lens fitting
14. RGP Lens Fit Assessment and fluorescein pattern
15. Special RGP fitting (Aphakia, pseudo phakia & Keratoconus)
16. RGP over refraction and Lens flexure
17. Examination of old RGP Lens
18. RGP Lens parameters
19. Slit lamp examination of Contact Lens wearers

Theory:

1. SCL Materials & Review of manufacturing techniques
2. Comparison of RGP vs. SCL
3. Pre-fitting considerations for SCL
4. Fitting philosophies for SCL
5. Fit assessment in Soft Contact Lenses: Types of fit – Steep, Flat, Optimum
6. Calculation and finalising SCL parameters
 1. 6.1 Disposable lenses
 2. 6.2 Advantages and availability

7. Soft Toric CL
 1. 7.1 Stabilization techniques
 2. 7.2 Parameter selection
 3. 7.3 Fitting assessment
8. Common Handling Instructions
 1. 8.1 Insertion & Removal Techniques
 2. 8.2 Do's and Don't's
9. Care and Maintenance of Soft lenses
 1. 9.1 Cleaning agents & Importance
 2. 9.2 Rinsing agents & Importance
 3. 9.3 Disinfecting agents & importance
 4. 9.4 Lubricating & Enzymatic cleaners
10. Follow up visit examination
11. Complications of Soft lenses
12. Therapeutic contact lenses

- 12.1 Indications
- 12.2 Fitting consideration
13. Specialty fitting
 - 13.1 Aphakia
 - 13.2 Pediatric
 - 13.3 Post refractive surgery
14. Management of Presbyopia with Contact lenses

Practical:

1. Examination of old soft Lens
2. RGP Lens fitting
3. RGP Lens Fit Assessment and fluorescein pattern
4. Special RGP fitting (Aphakia, pseudo phakia & Keratoconus)
5. RGP over refraction and Lens flexure
6. Examination of old RGP Lens
7. RGP Lens parameters
8. Fitting Cosmetic Contact Lens
9. Slit lamp examination of Contact Lens wearers
10. Fitting Toric Contact Lens
11. Bandage Contact Lens
12. SPM & Pachymetry at SN During Clinics
13. Specialty Contact Lens fitting (at SN during clinics)

Paper II: Low vision care, Geriatric optometry & Occupational Optometry

Low Vision Care

This subject deal with the definition of low vision, epidemiology aspect 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 and other rehabilitation measures.

The student will be knowledgeable in the following:

1. Definition and epidemiology of Low Vision
2. Clinical examination of Low vision subjects
3. Optical, Non-Optical, Electronic, and Assistive devices.
4. Training for Low Vision subjects with Low vision devices
5. Referrals and follow-up

Theory:

1. Definitions & classification of Low vision
2. Epidemiology of low vision
3. Model of low vision service
4. Pre-clinical evaluation of low vision patients – prognostic & psychological factors; psycho- social impact of low vision
5. Types of low vision aids – optical aids, non-optical aids & electronic devices
6. Optics of low vision aids
7. Clinical evaluation – assessment of visual acuity, visual field, selection of low vision aids, instruction & training
8. Pediatric Low Vision care
9. Low vision aids – dispensing & prescribing aspects
10. Visual rehabilitation & counseling
11. Legal aspects of Low vision in India
12. Case Analysis

Practical:

1. Practical 1: Attending in low vision care clinic and history taking.
2. Practical 2:
 1. 2.1 Determining the type of telescope and its magnification (Direct comparison method & calculated method)
 2. 2.2 Determining the change in field of view with different magnification and different eye to lens distances with telescopes and magnifiers.
3. Practical 3:
 1. 3.1 Inducing visual impairment and prescribing magnification.
 2. 3.2 Determining reading speed with different types of low vision aids with same magnification.
 3. 3.3 Determining reading speed with a low vision aid of different magnifications.

GERIATRIC OPTOMETRY

This subject deals with general and ocular physiological changes of ageing, common geriatric systemic and ocular diseases, clinical approach of geriatric patients, pharmacological aspects of ageing ,and spectacle dispensing aspects in ageing patients.

The student on taking this course should

1. Be able to identify, investigate the age related changes in the eyes.
2. Be able to counsel the elderly
3. Be able to dispense spectacles with proper instructions.
4. Adequately gained knowledge on common ocular diseases.

COURSE PLAN (Total: 20 hours)

1. Structural , and morphological changes of eye in elderly
2. Physiological changes in eye in the course of aging.
3. Introduction to geriatric medicine – epidemiology , need for optometry care, systemic diseases (Hypertension, Atherosclerosis, coronary heart disease, congestive Heart failure, Cerebrovascular disease, Diabetes, COPD)
4. Optometric Examination of the Older Adult
5. Ocular diseases common in old eye, with special reference to cataract, glaucoma, macular disorders, vascular diseases of the eye
6. Contact lenses in elderly
7. Pharmacological aspects of aging
8. Low vision causes, management and rehabilitation in geriatrics.
9. Spectacle dispensing in elderly – Considerations of spectacle lenses and frames

RESEARCH METHODOLOGY AND BIOSTATISTICS

INSTRUCTOR INCHARGE: Biostatistician/Epidemiologist or Higher optometry holder
Introduction to research methods

1. Identifying research problem
2. Ethical issues in research
3. Research design
4. Types of Data
5. Research tools and Data collection methods
6. Sampling methods
7. Developing a research proposal

Biostatistics

1. Basics of Biostatistics

1. 1.1 Introduction of Biostatistics
2. 1.2 Measures of Morality
3. 1.3 Sampling

4. 1.4 Statistical significance
5. 1.5 Correlation
6. 1.6 Sample size determination.
7. 1.7 Statistics –Collection of Data - presentation including classification and diagrammatic representation –frequency distribution. Measures of central tendency; measures of dispersion.
- 1.8 Theoretical distributions.
 - 1.8.1 Binomial
 - 1.8.2 Normal
 - 1.8.3 Sampling –necessity of methods and techniques.
 - 1.8.4 Chi. Square test (2 x 2)
2. Hospital Statistics
3. Use of computerized software for statistics

Public Health and Community Optometry

The course provides students the opportunity to continue to develop confidence and increased skill in diagnosis and treatment delivery. Students will demonstrate competence in basic, intermediate and advance procedure in those areas. Students will participate in advance and specialized diagnostic and management procedure. Students will get practical experience of the knowledge acquired from geriatric and paediatric optometry courses. Hands-on experience under supervision will be provided in various outreach programmes namely, school vision screening, glaucoma and diabetic retinopathy screening etc., Students also get hand-on practical sessions on the following courses namely, contact lens, low vision care, geriatric optometry and paediatric optometry.

Students will be knowledgeable in the following areas:

1. Community based eye care in India.
2. Prevalence of various eye diseases
3. Developing Information Education Communication material on eye and vision care for the benefit of the public
4. Organize health education programmes in the community
5. Vision screening for various eye diseases in the community and for different age groups.

Theory:

1. Public Health Optometry: Concepts and implementation, Stages of diseases
2. Dimensions, determinants and indicators of health
3. Levels of disease prevention and levels of health care patterns
4. Epidemiology of blindness – Defining blindness and visual impairment
5. Eye in primary health care
6. Contrasting between Clinical and community health programs

7. Community Eye Care Programs
8. Community based rehabilitation programs
9. Nutritional Blindness with reference to Vitamin A deficiency
10. Vision 2020: The Right to Sight
11. Screening for eye diseases
12. National and International health agencies, NPCB
13. Role of an optometrist in Public Health
14. Organization and Management of Eye Care Programs – Service Delivery models
15. Health manpower and planning & Health Economics
16. Evaluation and assessment of health programmes
17. Optometrists role in school eye health programmes
18. Basics of Tele Optometry and its application in Public Health
19. Information, Education and Communication for Eye Care programs

1. Business Management:

1. 1.1 Practice establishment and development
2. 1.2 Stock control and costing
3. 1.3 Staffing and staff relations
4. 1.4 Business computerization
2. Accounting Principles
 1. 2.1 Sources of finance
 2. 2.2 Bookkeeping and cash flow
3. Taxation and taxation planning
4. Professionalism and Values
 1. 4.1 Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality
 2. 4.2 Personal values- ethical or moral values
 3. 4.3 Attitude and behaviour- professional behaviour, treating people equally
 4. 4.4 Code of conduct , professional accountability and responsibility, misconduct
 5. 4.5 Differences between professions and importance of team efforts
 6. 4.6 Cultural issues in the healthcare environment

Occupational Optometry

This course deals with general aspects of occupational health, Visual demand in various job, task analysing method ,visual standards for various jobs , occupational hazards and remedial aspects through classroom sessions and field visit to the factories.

At the end the students will be knowledgeable in the following aspects:

1. In visual requirements of jobs;

2. In effects of physical, chemical and other hazards on eye and vision;
3. To identify occupational causes of visual and eye problems;
4. To be able to prescribe suitable corrective lenses and eye protective wear and
5. To set visual requirements, standards for different jobs.

Theory:

1. Introduction to Occupational health, hygiene and safety, international bodies like ILO, WHO, National bodies etc.

1.1 Acts and Rules - Factories Act, WCA, ESI Act.

2. Electromagnetic Radiation and its effects on Eye
3. Light – Definitions and units, Sources, advantages and disadvantages, standards
4. Color – Definition, Color theory, Color coding, Color defects, Color Vision tests
5. Occupational hazards and preventive/protective methods
6. Task Analysis
7. Industrial Vision Screening – Modified clinical method and Industrial Vision test
8. Vision Standards – Railways, Roadways, Airlines
9. Visual Display Units
10. Contact lens and work

COURSE AND EXAMINATION REGULATIONS

Attendance:

- Students are required to attend 75% or more of all theory classes held, and 75% or more of practical in each subject to be eligible to appear in the final examination. Under no condition will a student with less than the prescribed attendance in any subject in theory and practical separately shall be allowed to appear in the Annual examination of that subject.
- Students with less than 75% attendance in theory and practical separately at the end of any year must start afresh by joining the junior batch of students. No extra classes will be arranged to make such students eligible for the final annual examinations. The attendance accrued in the previous academic year in those subject(s) will not be transferred. The student will need to secure 75% attendance afresh in theory and practical/laboratory postings after joining the junior batch to become eligible to appear in the final summative examination.
- The 25% leverage in attendance includes all types of leaves (including leave on medical grounds). For absence because of illness or any medical condition, a duly approved medical leave from Dean (Academic) with medical and fitness certificate issued/verified by authorized JIPMER clinical faculty member is mandatory. Certificate must be submitted before or within 10 days after availing medical leave.
- Students who are detained in all the subjects of a year due to lack of attendance should join the classes with junior batch within 7 days of declaration of the eligibility/detention list or when classes commence, whichever is earlier.
- Students who are detained in one or more subject(s) because of lack of attendance but are eligible to appear for final Annual examination in at least one subject of the year should join classes with junior batch within 7 days of completion of the last final theory/practical examination or when classes, whichever is earlier. Attendance will be calculated from the date of joining.
- A show cause notice will be issued to students on continuous unauthorized absence without prior permission for two weeks or more. If such absence extends to a period more than one month for any reason, the student is liable for termination for the course. The decision of the competent authority is final.
- There is **no condonation permissible** for shortage of attendance.

Internal Assessment (IA)

- A minimum of three notified internal assessments will be held periodically in each year (in a one-year period) and one model examination before the final annual examination.
- Each of the notified IA tests will carry 20% weightage and the model examination will carry 40% weightage. The sum of notified IA tests and model examination will decide the eligibility to appear in the examination and for contribution to aggregate marks.

- A student must secure at least 30% of the maximum marks fixed for internal assessment in theory and practical/clinical separately in a particular subject to be eligible to appear for the final annual examination in that subject.
- Of the final total aggregate marks in each subject, internal assessment marks will contribute 40% and annual examination marks will contribute the remaining 60%. This will apply to both theory and practical/clinical papers separately.
- If a student misses up to one notified test because of illness, marks of the remaining notified tests can be considered for calculating the internal assessment, ignoring the absence on medical grounds. To avail this concession, the student should submit a valid medical certificate signed by the treating clinical faculty member of JIPMER before or within 10 days after the missed test. This exemption will not apply to model examination. This is applicable only up to one missed notified internal assessment test.
- No repeat/additional notified internal assessment or model examination will be conducted.
- Students who are detained in all the subjects of a year because of lack of sufficient internal assessment marks should join the classes with junior batch within 7 days of declaration of the eligibility/detention list or when classes of the year commence, whichever is earlier.
- Students who are detained in one or more subject(s) due to lack of sufficient internal assessment marks but are eligible to appear in the annual examination in at least one subject of the year should join classes with junior batch within 7 days of completion of the last annual theory/practical examination or when classes of the year commence, whichever is earlier.
- The internal assessment marks accrued in the previous year will not be transferred to the next year.

Annual Examinations

Number and timing of examinations

- Annual examinations will be held at the end of each academic year. The Institute shall conduct not more than two annual examinations in an academic year, a regular annual and a supplementary examination in each subject. The supplementary examinations will be held within 6 weeks after publication of the result of the regular annual examination.
- Practical Examinations shall be jointly conducted by one internal and one external examiner duly appointed by the Professor of Examinations.
- Students should obtain a minimum of 40% in the annual examination and a minimum of 50% in the final total aggregate (total of internal assessment and annual examination marks) in a subject (theory and practical separately) to be declared as pass in that subject.

Marks scheme:

	Maximum marks
Theory	200
Practical	100
Total	300

Theory

	Maximum marks
Internal Assessment test 1 (weighted)	16
Internal Assessment test 2 (weighted)	16
Internal Assessment test 3 (weighted)	16
Model Examination	32
Annual Theory Examination	100
Viva-voce Examination	20
Total Theory marks	200

Practical

	Maximum marks
Internal Assessment test 1 (weighted)	7
Internal Assessment test 2 (weighted)	7
Internal Assessment test 3 (weighted)	7
Model Examination	14
Record marks	5
Annual Practical Examination	60
Total Practical marks	100

Question paper pattern

	Maximum marks
Section A	50
Section B	50
Total	100

Each section

		Marks
Answer in detail	1 X 10	10
Short notes	5 X 5	25
Brief answers	5 X 3	15
		50

Number of attempts and Training Period

- The academic program of the BSc Allied Health Sciences courses must be completed within 6 years from the date of joining (excluding internship). Maximum permissible duration for each year shall be four years and a maximum four attempts (including the annual and supplementary examinations) in any subject will be permitted.
- If a student does not appear in both theory and practical final examination, it will NOT be considered as an attempt for the purpose of calculation of maximum number of attempts in a subject.
- If a student appears for theory in the Annual Examination but does not appear for Practical Examination or vice-versa, his/her theory or practical appearance shall be counted as an attempt. In the next attempt, the student will have to appear for both Theory and Practical Examinations. Mere submission of application form for examination will not be considered as an attempt.
- Passing in the exams of all the previous year subjects is compulsory before proceeding to the classes of next phase.
- A student who fails in theory and/or practical papers of one or more subjects in the regular annual examinations at the end of each year can appear in the supplementary examination (to be held within 6 weeks of announcement of the regular annual examination results) in those subjects.
- If he/she passes these subjects in the supplementary examination, he/she should join the regular batch within 7 days of declaration of supplementary examination results or when classes commence, whichever is earlier. Attendance calculation for students who join after passing supplementary examination will begin from their date of joining of that year.
- Students who fail in theory and/or practical in one or more subjects in the supplementary examination and those who do not appear in the supplementary examination should join classes with the junior batch within 7 days of declaration of supplementary examination results or when classes, whichever is earlier. These students should secure 75% attendance and 30% internal assessment afresh to be eligible to appear in the final regular annual examination of that year along with the junior batch. Attendance calculation for students who join after failing in supplementary examination will begin from their date of joining the year with junior batch.
- A maximum of four attempts in any subject is allowed. If a student fails even in the 4th attempt, no further chances will be given, and his/her name will be struck off the rolls of JIPMER.
- No grace marks will be awarded for either theory or practical examinations under any circumstances.

Model Question paper

Phase I - Paper I: Foundation course

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

1. Answer the following question in detail: 1 x 10 = 10

- a. Describe in detail healthcare delivery system in India at the primary, secondary, and tertiary levels.

2. Write short notes on the following: 5 x 5 = 25

- a. What is the role of processor and RAM in a computer?
- b. Describe the types of networks in computing.
- c. Write a short note on right to healthcare.
- d. What is medical negligence? What are the laws governing medical negligence in India?
- e. Write in brief about the importance of informed consent and the process.

3. Answer the following questions briefly: 5 x 3 = 15

- a. What are the components of a medical term?
- b. What are the input and output devices of a computer?
- c. What is paralanguage? What are its implications?
- d. Describe the characteristics of good communicator.
- e. What are the alternative medicine systems recognised by the Government of India?

Section B

4. Answer the following question in detail: 1 x 10 = 10

- a. Explain the concepts of quality of care. Describe various approaches to quality improvement.

5. Write short notes on the following: 5 x 5 = 25

- a. Describe the principles of management with suitable examples.
- b. Describe the methods of disinfection in biomedical waste management.
- c. Describe the methods of prevention & control of common healthcare associated infections.
- d. Classify the types of antibiotic resistance and describe each of them.
- e. Write a short note on research study designs.

6. Answer the following questions briefly: 5 x 3 = 15

- a. What are the components of cardiopulmonary resuscitation?
- b. What is integrity and what is its importance of integrity in healthcare practice?
- c. What are the qualities of a good leader?
- d. What are the different types of data?
- e. Describe the concept of ethics and its relevance in healthcare practice.

Model Question paper

Phase I - Paper II: Anatomy and Physiology

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A - Anatomy

- 1. Answer the following question in detail:** 1 x 10 = 10
- a. Describe the position, parts, structure, blood supply and supports of uterus.
- 2. Write short notes on the following:** 5 x 5 = 25
- a. Parts and blood supply of stomach
b. Simple epithelium
c. Histology of lymph node
d. Chambers and valves of heart
e. Surfaces and lobes of lung
- 3. Answer the following questions briefly:** 5 x 3 = 15
- a. Name three major salivary glands.
b. Mention two contents of spermatic cord
c. Name two paranasal air sinuses
d. Name the parts of small intestine
e. Name two upper limb muscles

Section – B - Physiology

- 4. Write essay answer on the following:** 1 x 10 = 10
- a. Define immunity. Mention the different types of immunity. Write briefly about the different types of immunity. (2+2+6)
- 5. Write short notes on the following:** 5 x 5 = 25
- a. Active transport
b. Movements of small intestine
c. Factors affecting glomerular filtration rate
d. Oxygen haemoglobin (Oxy-Hb) dissociation curve
e. Factors regulating cardiac output
- 6. Answer the following questions briefly:** 5 x 3 = 15
- a. Name the hormones secreted from Adrenal gland
b. Mention the Indicators of ovulation
c. Define tidal volume. Mention its normal value.
d. Draw a labelled diagram of lead II ECG.
e. List four functions of hypothalamus.

Model Question paper

Phase I - Paper III: Pathology and Microbiology

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A - Pathology

- 1. Answer the following question in detail:** 1 x 10 = 10
- a. What is inflammation? What are the cardinal signs of inflammation? Mention the difference between acute and chronic inflammation. Add a note on granuloma with example. (1+2+4+3)
- 2. Write short notes on the following:** 5 x 5 = 25
- a. Define necrosis. Give examples of different types of necrosis. Differences between necrosis and apoptosis.
- b. What is thrombosis? Explain Virchow's triad.
- c. Define neoplasia. What are the differences between benign and malignant tumours? List the different routes of metastasis.
- d. Mention the differences between wound healing by primary and secondary intention.
- e. Principles and procedures of blood grouping and cross-matching.
- 3. Answer the following questions briefly:** 5 x 3 = 15
- a. Define anaemia. Give any two causes of anaemia.
- b. What is jaundice? Give the classification based on pathophysiology.
- c. What is atherosclerosis? Give some of its risk factors.
- d. What is nephrotic syndrome? Give any two examples.
- e. How will you do urine analysis?

Section – B - Microbiology

- 4. Write essay answer on the following:** 1 x 10 = 10
- a. Define sterilization. Draw a labelled diagram of autoclave. Write principle of autoclave and its application in hospital. (1+3+3+3)
- 5. Write short notes on the following:** 5 x 5 = 25
- a. Enumerate vector borne diseases. Add a note on the laboratory diagnosis of malaria
- b. What do you understand by segregation of biomedical waste? How is it done in your hospital?
- c. Describe in detail about various method of urine sample collection
- d. Enumerate sexually transmitted microorganisms. Write laboratory diagnosis of HIV
- e. Describe laboratory diagnosis of Mucormycosis.
- 6. Answer the following questions briefly:** 5 x 3 = 15
- a. Name two transport media
- b. Name two foodborne pathogens
- c. Enumerate four Personal Protective Equipment (PPE)
- d. Name two nosocomial pathogens
- e. List two opportunistic fungal infection

Model Question paper

Phase I - Paper IV: Applied Basic sciences in Ophthalmology & Biochemistry

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

1. Answer the following question in detail:

1 x 10 = 10

- a. Discuss pupillary light reflex with diagram. Discuss anatomy and actions of extraocular muscles.

2. Write short notes on the following:

5 x 5 = 25

- a. Hering's law.
- b. Visual acuity.
- c. Aqueous humor.
- d. Optic nerve.
- e. Anatomy of cornea.

3. Answer the following questions briefly:

5 x 3 = 15

- a. Colour vision.
- b. Bitot spots.
- c. Presbyopia.
- d. Oculomotor nerve.
- e. Cataract.

Section B

4. Write essay answer on the following:

1 x 10 = 10

- a. Describe in detail the sources, biochemical functions, and deficiency manifestation of calcium.

5. Write short notes on the following:

5 x 5 = 25

- a. Explain the working principle of gel filtration chromatography.
- b. Mention the biochemical tests for assessment of iron status and briefly describe them.
- c. Describe the mechanisms of action of enzymes.
- d. Describe the biochemical functions of Vitamin K.
- e. What is basal metabolic rate and what is its significance?

6. Answer the following questions briefly:

5 x 3 = 15

- a. How is 1M of NaCl prepared?
- b. What is Bohr effect?
- c. Name and briefly describe a test to detect protein in urine.
- d. Name any two richest sources of vitamin C and describe its role in the human body.
- e. Describe various types of pipettes and their applications.

Model Question paper

Phase II - Paper I: Visual Optics & Clinical examination of visual system (CEVS) AND Ocular disease & Optometric instruments

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

1. Answer the following question in detail: 1 x 10 = 10

- a. Visual acuity testing in preverbal and verbal children

2. Write short notes on the following: 5 x 5 = 25

- a. Hirschberg's corneal reflex test
- b. List the findings that you observe on external examination
- c. Swinging flash light test
- d. Slit lamp illumination techniques
- e. Astigmatism and its types

3. Answer the following questions briefly: 5 x 3 = 15

- a. Emmetropization.
- b. Optical axis
- c. Principle of retinoscopy
- d. Anisometria
- e. Any two types of accommodative anomalies

Section B

4. Write essay answer on the following: 1 x 10 = 10

- a. Classification of Hypertensive retinopathy, risk factors and treatment.

5. Write short notes on the following: 5 x 5 = 25

- a. IOL power calculation.
- b. Automated Lensometer.
- c. Pupillometer.
- d. Classify perimeters and mention the field defects in glaucoma.
- e. Uses of Maddox rod.

6. Answer the following questions briefly: 5 x 3 = 15

- a. Keratoconus.
- b. Pterygium.
- c. Retinitis pigmentosa.
- d. Xerophthalmia.
- e. Optic neuritis.

Model Question paper
Phase II - Paper II: Geometric Optics & Physical Optics
Maximum marks: 100 Maximum duration: 3 hours
Answer all the questions. Draw suitable diagrams where necessary

Section A

1. Answer the following question in detail: 1 x 10 = 10

- a. What is dispersive power of prism?

2. Write short notes on the following: 5 x 5 = 25

- a. Describe in detail about laws of reflection.
b. Sources and properties of light
c. What is total internal reflection? Give its importance.
d. What are cardinal points? Explain with diagram
e. What is magnification? Give its type and formulae

3. Answer the following questions briefly: 5 x 3 = 15

- a. What is constringence?
b. Define point source.
c. What is wavelet?
d. State Fermat's principle
e. Concept of Vergence

Section B

4. Write essay answer on the following: 1 x 10 = 10

- a. What is photon ray? Define photometric measure units.

5. Write short notes on the following: 5 x 5 = 25

- a. What is Maxima and Minima? Draw diagram.
b. Amplitude and wavelength
c. Lens defects
d. Differentiate between OR and ER
e. Applications of Polaroids

6. Answer the following questions briefly: 5 x 3 = 15

- f. What is wave front? Draw with explanation
g. What is Rayleigh's scattering of light?
h. What is Tyndall effect?
i. What's specific rotation of levo rotation?
j. What is refractive index? Give examples.

Model Question paper

Phase II - Paper III: Dispensing Optics & Optometric Optics

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

1. Answer the following question in detail:

1 x 10 = 10

- a. What is lens? Write about different types of lenses. Write in detail about unit of lens power.

2. Write short notes on the following:

5 x 5 = 25

- a. Transpose into toric form with -6.00D base curve:
+2.75DS / -1.50DCX90
-3.75DS / +2.50DCX180
-5.50DS / -4.00DCX80
- b. Convert the following angles to prism dioptres.
1° (ii) 8° 53' (iii) 2° 3' (iv) 7°
- c. Transpose the prescription +2.00DS/+1.50DCx45 into toric form with a-7.00D base curve. If the toric prescription is made up in glass of refractive index 1.6. What are the surface curvatures of the lens in reciprocal meters?
- d. What is rotatory prism? Write the formula for finding it.
- e. Aspheric lenses. Explain its design and list its uses in ophthalmic purpose.

3. Answer the following questions briefly:

5 x 3 = 15

- a. What is spherical equivalent of a spherocylindrical lens?
- b. Express in standard notation
(i) base 270 (ii) base 45 (iii) base 120 (iv) base 180.
- c. Transpose +0.50DS/-0.25DCxH into cross cylinder form.
- d. Transpose +5.50DS/+2.25DCX85 into negative cylinder forms.
- e. Abbe number.

Section B

4. Write essay answer on the following:

1 x 10 = 10

- a. Significance of IPD measurements and eye center.

5. Write short notes on the following:

5 x 5 = 25

- a. Write the components of ophthalmic prescription.
- b. What is progressive addition lenses?
- c. What are CR 39, Polycarbonate, PMMA lenses?
- d. Advantages of PMMA.
- e. How will you choose frame material for elderly people and young children?

6. Answer the following questions briefly:

5 x 3 = 15

- a. What are half eye glasses?
- b. What is pupillometer?
- c. What is an auto Lens Edger?
- d. What is meant by tinted lens?
- e. What is DBL?

Model Question paper
Phase III - Paper I: Binocular vision & Paediatric optometry and systemic diseases & Public Health Optometry

Maximum marks: 100 Maximum duration: 3 hours
Answer all the questions. Draw suitable diagrams where necessary

Section A

- 1. Answer the following question in detail:** 1 x 10 = 10
a. Explain sensory evaluation in a patient with non-strabismic binocular vision disorder.
- 2. Write short notes on the following:** 5 x 5 = 25
a. What is the calculated AC/A ratio for a client with an IPD of 62 mm, he is 4 Δ exophoric at distance and 6 Δ exophoric at near with a WD of 40cm?
b. What are the general principles and guidelines for Oculomotor therapy?
c. What are the signs of Accommodative spasm?
d. Name the tests used for evaluating positive fusional vergence.
e. MEM retinoscopy.
- 3. Answer the following questions briefly:** 5 x 3 = 15
a. Why do patients with nystagmus have AHP?
b. Prerequisites for doing NPC.
c. How are binocular vision disorders classified?
d. When do you consider giving added plus power?
e. When is cycloplegic refraction indicated in patients with NSBVA?

Section B

- 4. Write essay answer on the following:** 1 x 10 = 10
a. Discuss in detail about ocular manifestations in tuberculosis.
- 5. Write short notes on the following:** 5 x 5 = 25
a. Ocular findings in thyroid eye disease.
b. Ocular features of Rheumatoid arthritis.
c. Drugs causing ocular toxicity.
d. Ocular findings in neurofibromatosis.
e. Retinal findings in Leukemia.
- 6. Answer the following questions briefly:** 5 x 3 = 15
a. Iris coloboma.
b. Cross fixation.
c. Lea symbols.
d. Arcus senilis.
e. Timolol.

Model Question paper

Phase III - Paper II: Contact lens

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

1. Answer the following question in detail: 1 x 10 = 10

- a. Classify contact lenses. Write advantages and disadvantages of contact lenses in detail.

2. Write short notes on the following: 5 x 5 = 25

- a. Write about RGP contact lens fitting.
b. Contact lens induced Giant papillary conjunctivitis and treatment.
c. Define Keratometry. Write uses of keratometry in contact lens fitting.
d. Contact lens materials.
e. Contact lens solution and properties.

3. Answer the following questions briefly: 5 x 3 = 15

- a. Name the deposits on soft contact lens.
b. Define Oxygen Transmissibility.
c. Fluorescein finding in steep fit.
d. Give two diagnostic uses of contact lenses.
e. What is Sattler's Veil?

Section B

4. Write essay answer on the following: 1 x 10 = 10

- a. Write in detail about soft contact lens care and maintenance.

5. Write short notes on the following: 5 x 5 = 25

- a. Contact lens options for keratoconus patients.
b. Causes of decentration of soft contact lens.
c. Corneal anatomy with diagram.
d. Optics of contact lens.
e. Extended wear contact lenses.

6. Answer the following questions briefly: 5 x 3 = 15

- a. What is Hybrid contact lens?
b. What is HEMA?
c. How do you examine the tear film quality?
d. Over refraction.
e. What is Acanthamoeba keratitis?

Model Question paper

Phase III - Paper III: Low vision care, Geriatric Optometry & Occupational Optometry

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

- 1. Answer the following question in detail:** 1 x 10 = 10
a. Discuss the optical devices available for visual rehabilitation.
- 2. Write short notes on the following:** 5 x 5 = 25
a. Teller acuity cards.
b. WHO's definition and classification of blindness and visual impairment.
c. Illustrate the prediction of near vision add with an example.
d. Non-optical methods of visual rehabilitation.
e. Functional evaluation of an adult with low vision.
- 3. Answer the following questions briefly:** 5 x 3 = 15
a. What are most common causes of low vision in the elderly age group?
b. Name two questions that you ask to evaluate the level of acceptance from the patient.
c. Mention two common disorders in old age with low vision.
d. What is telemicroscopes?
e. Functional consequences of vision impairment.
f. Hemianopic glasses.

Section B

- 4. Write essay answer on the following:** 1 x 10 = 10
a. What is screening? Discuss sensitivity and specificity of screening tests with examples.
- 5. Write short notes on the following:** 5 x 5 = 25
a. Discuss the mechanical occupational eye hazards.
b. Write short notes on radiation eye injuries.
c. Discuss in detail about occupational hazard of COVID-19.
d. What is the health and sickness role?
e. Discuss the guidelines for use of contact lens in industrial environment?
- 6. Answer the following questions briefly:** 5 x 3 = 15
a. Occupational vision assessment.
b. Sports contact lens.
c. Occupational concerns of an aircraft pilot.
d. Management of chemical injuries on the ocular surface.
e. Types of sports eye injuries.
f. Specific occupational needs for a tennis player.
