

The New Syllabus (January 2007)

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Learning outcomes and clinical/practical competencies

Regarding learning outcomes:

Learning outcomes can be written in many different ways and are often based on a pedagogical platform. One of the most commonly used platforms or pedagogical taxonomies is the SOLO-taxonomy developed by Biggs and Collins (1999).

Within the SOLO-taxonomy progression in learning outcome is divided into five levels:

- 1) The student misses the point,
- 2) The student is able to identify and perform simple procedures within the area,
- 3) In addition to level 2, the student is able to name, describe, and combine topics within the area,
- 4) In addition to level 2 and 3, the student is able to compare, differentiate, explain connections, make an analysis, and put into practice the topics within the area, and
- 5) In addition to level 2,3, and 4, the student is able to come up with new theories and hypotheses, make a general statement, and reflect about topics within the area.

In higher education, like reaching the European Diploma, the student should reach level 4 or 5 within all areas/subjects.

Subject 1: Geometrical Optics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into geometrical optics in order for the candidate to be able to understand and solve problems related to the eye and optical instruments/lenses, their function and correction. Knowledge and understanding should be demonstrated in the areas of:

(1) refraction at single spherical or plane surfaces, (2) thin lenses, (3) thick lenses, (4) aberrations, (5) apertures, (6) spherocylindrical lenses, (7) thin prisms, (8) mirrors, and (ophthalmic and optical instruments).

The aim is to achieve knowledge of the fundamentals of geometrical optics and how they apply to the human eye.

Subject 2: Physical Optics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into physical optics in order for the candidate to be able to understand and solve problems related to the eye and optical instruments/lenses, their function and correction. Knowledge and understanding should be demonstrated in the areas of:

- (3) wave optics, (2) interaction of light on matter, (3) polarization, (4) transmission through successive
- (4) polarisers, and (5) image quality.

The aim is to achieve knowledge of the fundamentals of physical optics and how they apply to the human eye.

Subject 3: Visual Optics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into visual optics in order for the candidate to be able to understand and solve problems related to image formation, both qualitative and quantitative, for the candidate to investigate the optics of the human visual system and refractive correction. Knowledge and understanding should be demonstrated in the areas of: (1) schematic eye models, (2) dioptrics of the eye, (3) entopic phenomena, (4) quality of retinal image, and (5) radiation and the eye.

Subject 4: Visual Perception (from summer 2010 this belongs to Part C and is examined in Part C, too!!)

Learning outcomes:

The candidates should demonstrate knowledge and understanding of the physical and physiological aspects of vision including the principals of psychophysical measurements, visual detection, visual discrimination, visual search and attention and binocular vision. Knowledge and understanding should be demonstrated in the areas of : (1) visual pathway, (2) colour vision, (3) space perception, (4) form perception, (5) light perception, (6) motion perception, (7) temporal perception, (8) basic psychophysical methods and theory, (9) psychophysical scaling methods and theory, and (10) signal detection methods and theory.

Subject 5: Optical appliances

Learning outcomes:

The candidates should demonstrate knowledge and skills of optical appliances and dispensing and how visual correction interact with the eye. Knowledge and skills should be demonstrated in the areas of: (1) physical characteristics of ophthalmic lenses, (2) optical characteristics of ophthalmic lenses, (3) ophthalmic prisms and prismatic effect of lenses, (4) multifocal lenses, (5) physical characteristics and biological compatibility of frame materials, (6) specification and nomenclature of spectacle frame components, (7) optical and spectacle frame considerations of high-powered lenses, (8) spectacle magnification, (9) absorptive lenses, (10) impact resistance, (11) optical tolerances and physical requirements of ophthalmic lenses and frame materials (EN), and (12) spectacle applications.

Clinical/practical competencis:

The ability to advise on and to dispense the most suitable form of optical correction taking into account durability, comfort, cosmetic appearance and lifestyle.

The ability to measure and verify optical appliances, taking into account relevant standards.

An understanding of prismatic effect, and the manipulation of lens form and setting to obtain the desired control of prismatic effect.

The ability to manage non-tolerance cases.

Subject 6: Occupational optics

Learning outcomes:

The candidates should demonstrate knowledge and understanding and be able to discuss and test visual function in relation occupational optics. Knowledge, understanding and testing skills should be demonstrated in the areas of : (1) visual performance, (2) ocular injuries, (3) eye protection and its regulations, (4) lamps and lighting and regulations regarding lighting, (5) visual display units, and (6) regulations related to vision and driving.

Clinical/practical competencis:

An understanding of eye protection regulations, and relevant standards, and the ability to advise on occupational visual requirements.

The ability to prescribe and dispense spectacles for vocational use.

Subject 7: Vision and Aging

Learning outcomes:

The candidates should demonstrate knowledge and understanding and be able to discuss, test and explain the human development of the visual system and its response to aging.

Knowledge, understanding and testing skills should be demonstrated in the areas of :

- (1) normal vision development in the infant and child, (2) normal motor development in the infant and child, (3) Normal cognitive and social development in the infant and child,
- (4) effects of early environmental restrictions, (5) normal changes in vision with ageing,
- (6) Anomalies of Child Development, (7) clinical techniques and tests to assess the development of children at various ages, (8) clinical characteristics of children who deviate from normal patterns of development, and epidemiology of developmental disorders
- (9) tests that diagnose vision problems which may be associated with deviations from normal patterns of development, (10) tests used by optometrists to determine a child's level of visual-perceptual development, (11) role of the optometrist and other disciplines in screening, evaluating, managing and referring children who deviate from normal patterns of development,
- (12) anomalies of the Ageing Adult, (13) clinical characteristics of changes in perceptual function (non-visual) associated with ageing, (14) symptom profiles, clinical procedures, and tests identifying changes in vision,
- (15) clinical management of ageing patients with multisensory loss,
- (16) assessment of the need for referral and consultation with other disciplines,
- 17) colour vision anomalies by type and prevalence,
- (18) colour vision tests used for both screening and diagnosis of congenital colour vision anomalies,
- (19) conditions for colour vision testing, (20) societal implications of colour vision anomalies, and
- (21) assessment of the need for referral and consultation with other disciplines.

Subject 8: Refraction

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and refract patients in the most suitable way. Knowledge, understanding and testing skills should be demonstrated in the areas of : (1) different refractive states of the eye, (2) mechanisms of presbyopia, (3)anamnesis, (4) preliminary testing, (5) Objective static and dynamic refractive status, including automatic refractive devices, (6) standard subjective refraction procedures, including astigmatic diais, crossed cylinders, stenopaic slit, fogging methods and equalisation (duo chrome) techniques, (7) binocular subjective refraction procedures, including accommodation binocular balancing methods, (8) binocular subjective refraction procedures, including accommodation binocular balancing methods, (9) cycloplegic subjective and objective techniques, (10) automatic computer assisted subjective procedures, laser refraction and variations in procedures for the various ametropias, (11) identification, treatment and management using spectacle and contact lenses and prognosis, and (12) observation and recognition of clinical signs, and techniques and skills for determining the near add.

Clinical/practical competencis:

The ability to take an accurate history from patients with a range of optometric conditions.

The ability to elicit significant symptoms.

The ability to elicit relevant family history.

The ability to elicit issues pertaining to the patient's general health, medication, work, sports, lifestyle and special needs.

The ability to impart to patients and explanation of their physiological or pathological eye condition.

An ability to understand a patient's fears, anxieties and concerns about their visual welfare, the eye examination and the possible ocular side effects of medication.

An ability to understand the patient's expectations and aspirations and manage empathetically situations here these cannot be met.

The ability to communicate with patients who have poor, or non-verbal, communication skills, or those who are confused, reticent or who might mislead.

The ability to communicate bad news to patients in an empathetic and understandable way.

The ability to manage patients in a safe, ethical and confidential fashion.

The ability to create and to keep clear, accurate and contemporaneous patient records.

The ability to interpret and respond appropriately to existing records.

The ability to make a judgement regarding referral and an understanding of referral pathways.

The ability to demonstrate an understanding of the legal, professional and ethical obligations of a registered optometrist.

The ability to refract a range of patients with common optometric problems by appropriate objective and subjective means.

The ability to make appropriate prescribing and management decisions based on the refractive and oculomotor status.

The ability to use appropriate ocular diagnostic drugs to aid refraction.

An understanding of the special examination needs of patients with learning and other disabilities.

An understanding of the special examination needs of patients with severe visual field defects.

The ability to manage non-tolerance cases.

Subject 9: Low Vision

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage patients whose vision cannot be improved significantly using conventional spectacles or contact lenses, in order to make the most of their residual vision using magnifying systems and imaging technology. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) definitions and regulations of low vision, (2) incidence and causes, (3) measurement of visual performance, (4) magnification, non-optical aids, (6) illumination and lighting, (7) aids for peripheral field, (8) eccentric viewing and steady eye strategy, (9) environmental modification, and (10) clinical procedures.

Clinical/practical competencis:

The ability to take an accurate history from patients with a range of optometric conditions.

The ability to elicit significant symptoms. The ability to elicit relevant family history

The ability to elicit issues pertaining to the patient's general health, medication, work, sports, lifestyle and special needs.

The ability to impart to patients and explanation of their physiological or pathological eye condition.

An ability to understand a patient's fears, anxieties and concerns about their visual welfare, the eye examination and the possible ocular side effects of medication.

An ability to understand the patient's expectations and aspirations and manage empathetically situations where these cannot be met.

The ability to communicate with patients who have poor, or non-verbal, communication skills, or those who are confused, reticent or who might mislead.

The ability to communicate bad news to patients in an empathetic and understandable way.

The ability to manage patients in a safe, ethical and confidential fashion.

The ability to create and to keep clear, accurate and contemporaneous patient records.

The ability to interpret and respond appropriately to existing records.

The ability to make a judgement regarding referral and an understanding of referral pathways.

The ability to demonstrate an understanding of the legal, professional and ethical obligations of a registered optometrist.

The ability to assess patients with impaired visual function

The ability to advise visually impaired patients about their impairment, disability or handicap.

The ability to advise on the use of, and to dispense simple low vision aids including: hand and stand magnifiers, typoscope and hand held telescopes.

The ability to advise on the use of and to dispense complex spectacle lens forms, including: multifocals, high corrections, and their applications to specific patient needs.

An understanding of the application of complex low vision aids, e.g., spectacle-mounted telescopes, CCTV.

Subject 10: Ocular Motility and Binocular Vision

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage patients who suffer from binocular vision problems and who are at risk of developing binocular vision problems. Knowledge, understanding and testing skills should be demonstrated in the areas of :

- (1) nature of binocular vision anomalies, (2) binocular vision routine examination,
- (3) examination of young children, (4) evaluation and management of heterophoria,
- (5) evaluation and management of heterotropia (strabismus), and
- (6) examination and management of incomitant deviations and nystagmus.

Clinical/practical competencis:

The ability to assess binocular status using objective and subjective tests.

An understanding of the management of patients with an anomaly of binocular vision.

The ability to investigate and manage adult patients presenting with heterophoria.

The ability to manage an adult patient with heterotropia.

The ability to manage children at risk of developing an anomaly of binocular vision.

The ability to manage children presenting with an anomaly of binocular vision.

The ability to manage a patient presenting with an incomitant deviation.

Subject 11: Contact Lenses

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and undertake examinations and management of patients wanting to wear or who are already wearing contact lenses. Knowledge, understanding and testing skills should be demonstrated in the areas of : (1) treatment and management of refractive/oculomotor/sensory integrative conditions using contact lenses, (2) lens types and materials: hard lenses; haptics; lathecut, moulded, and spincast soft lenses, (3) optics of contact lenses: curves, zones, widths and tear lens effects, sagittal depth; centre and edge thickness; flex, asphericity and toric designs and quadrant specific designs, and oblong geometries with reverse curves, (4) theories and methods of fitting: lens design, specifications of orders, lens verification and evaluation, insertion and removal techniques, design of wearing schedules, fluorescein evaluation and fitting criteria, (5) patient selection based upon history, analysis of primary care data, correlations of data, facial physiognomy, and contraindications; and management based upon education and patient handling and control, (6) the examination of a new prospective contact lens patient, the anterior segment examination and measurement, (7) contact lens selection from presently available types and forms of lenses, (8) care of lenses; handling; cleaning; preservatives available; disinfection methods and solutions, (9) follow-up care; adaptation, physiologic and post-fitting complications, allergic responses, lens changes and mechanical problems, (10) bifocal and astigmatic contact lenses; types, basis of selection and adaptation, techniques of fitting, and care for each, (11) specially designed lenses and fitting procedures for keratoconus and irregular corneas, for keratoplastic and after refractive surgeries, sports vision, diseased and traumatic corneas, cosmetic (prosthetic) use, iris colour changes and colour vision deficiencies, (12) Specially designed lenses and fitting procedures for Orthokeratologie, and (13) Parameter modification in theory and practice.

Clinical/practical competencis:

The ability to insert and remove contact lenses and instruct patients in these procedures.
The ability to fit soft contact lenses.
The ability to manage the aftercare of patients wearing soft contact lenses.
The ability to advise on contact lens materials and care regimes.
The ability to manage the aftercare of patients wearing rigid gas permeable contact lenses.
The ability to fit rigid gas permeable contact lenses.
An understanding of, and the ability to fit contact lenses to patients with astigmatism.
An understanding of the techniques used in fitting contact lenses to advise patients requiring complex visual correction.
The ability to manage patients in a safe, ethical and confidential fashion.
The ability to create and to keep clear, accurate and contemporaneous patient records.
The ability to interpret and respond appropriately to existing records.
The ability to make a judgement regarding referral and an understanding of referral pathways.
The ability to demonstrate an understanding of the legal, professional and ethical obligations of a registered optometrist.

Subject 12: Investigative techniques

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and undertake examinations of patients using investigative techniques. Knowledge, understanding and testing skills should be demonstrated in the areas of : (1) colour vision investigation, (2) keratometry, (3) retinoscopy, (4) automatic objective refraction, (5) slit lamp examination of the external and internal eye, (6) tonometry (contact and non-contact), (7) direct ophthalmoscopy, (8) monocular indirect ophthalmoscopy, (9) binocular indirect ophthalmoscopy, (10) gonioscopy, (11) lacrimal system evaluation, (12) fundus biomicroscopy, and (13) quantitative perimetry.

Clinical/practical competencis:

The ability to assess a patient's colour vision and to determine whether it achieves the standards required by various vocational groups.
The ability to use instruments in ocular examination and to understand the implications of the findings in terms of subsequent examination techniques.
The ability to assess the external eye and adnexa.
The ability to assess the tear film.
The ability to assess pupil reactions.
The ability to use a slit lamp.
The ability to use diagnostic drugs to aid ocular examination.
The ability to examine fundi using direct and indirect techniques.
The ability to use instruments to measure corneal curvature.
The ability to investigate visual fields and to analyse and interpret the results.
The ability to use a contact tonometer to measure intraocular pressure and analyse and interpret the results.
The ability to make an assessment of the fundus in the presence of media opacities.
The ability to use a slit lamp to detect anterior chamber signs of ocular inflammation.
The ability to assess visual fields of patients with reduced visual acuity.
Demonstrate an understanding of techniques for assessment of vision in infants.
An understanding of the assessment of visual function, including the use of specialist charts for distance and near vision, and the effects of lighting, contrast and glare.

Subject 13: Paediatric Optometry

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage children in an optometric setting. Knowledge, understanding and testing skills should be demonstrated in the areas of: (1) Paediatric communication skills, (2) Assessment of visual acuity, (3) Refractive examination, (4) Myopia, (5) Binocular vision disorders, (6) Paediatric eye disorders, (7) spectacle dispensing, (8) contact lenses, and (9) low vision assessment and management.

Clinical/practical competencis:

The ability to take an accurate history from patients with a range of optometric conditions.

The ability to elicit significant symptoms.

The ability to elicit relevant family history.

The ability to elicit issues pertaining to the patient's general health, medication, work, sports, lifestyle and special needs.

The ability to impart to patients and explanation of their physiological or pathological eye condition.

An ability to understand a patient's fears, anxieties and concerns about their visual welfare, the eye examination and the possible ocular side effects of medication.

An ability to understand the patient's expectations and aspirations and manage empathetically situations where these cannot be met.

The ability to communicate with patients who have poor, or non-verbal, communication skills, or those who are confused, reticent or who might mislead.

The ability to communicate bad news to patients in an empathetic and understandable way.

The ability to manage patients in a safe, ethical and confidential fashion.

The ability to create and to keep clear, accurate and contemporaneous patient records.

The ability to interpret and respond appropriately to existing records.

The ability to make a judgement regarding referral and an understanding of referral pathways.

The ability to demonstrate an understanding of the legal, professional and ethical obligations of a registered optometrist.

The ability to assess children's visual function using appropriate techniques.

Subject 14: Refractive Surgery

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and undertake examinations and management of patients wanting to undergo or who have undergone refractive surgery.

Knowledge, understanding and testing skills should be demonstrated in the areas of patient counselling and pre- and post operative assessments. Knowledge and understanding should be demonstrated in the different treatment options and postoperative complications.

Clinical/practical competencis:

The ability to properly advise on refractive surgery options and possible outcomes.

The ability to identify corneal ectasia and dystrophies and other contraindications to refractive surgery.

An understanding of which techniques that is necessary in the pre-operative assessments.

The ability to perform the techniques used in the pre-operative assessments.

The ability to manage the aftercare of patients having undergone refractive surgery.

The ability to identify post-operative complications.

The ability to manage patients in a safe, ethical and confidential fashion.

The ability to create and to keep clear, accurate and contemporaneous patient records.

The ability to interpret and respond appropriately to existing records.

The ability to make a judgement regarding referral and an understanding of referral pathways

The ability to demonstrate an understanding of the legal, professional and ethical obligations of a registered optometrist.

Subject 15: Anatomy and Histology

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into general anatomy and histology. Knowledge and understanding should be demonstrated in the areas of:

- (1) head and skull (muscles, arteries, veins, lymphs, cranial nerves, sinuses, vestibular system,
- (2) cells (membranes, compartments, organelles, stem cells, cell differentiation), and
- (3) tissues (epithelium, glands, connective tissue, muscle, blood, nerves).

Subject 16: Neuroscience

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into the area of neuroscience. Knowledge and understanding should be demonstrated in the areas of:

- (1) electrophysiology of the nerve cells (resting and action potential, synapses, receptors),
- (2) neuroanatomy (brain, cranial nerves, spinal cord, autonomic nervous system), and
- (3) neurophysiology (reflexes, pain and sensation, vestibular system, proprioceptive sensation, autonomic nervous system).

Subject 17: General Physiology and Biochemistry

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into physiology and biochemistry. Knowledge and understanding should be demonstrated in the areas of:

- (1) respiration, (2) gastrointestinal activity, (3) muscles, (4) body fluids, (5) renal system,
- (6) circulatory system, (7) endocrine system, (8) proteins, (9) carbohydrates,
- (10) lipids, (11) molecular biology, and
- (12) bioenergetics.

Subject 18: General Microbiology and Immunology

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into general microbiology and immunology.

Knowledge and understanding should be demonstrated in the areas of:

- (1) virology, (2) bacteriology, (3) mycology, (4) parasitology, (5) antigens and antibodies,
- (6) complement system, (7) non-specific immunity, (8) specific immunity,
- (9) hypersensitivity response, and (10) autoimmunity.

Subject 19: General Pharmacology

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into general pharmacology. Knowledge and understanding should be demonstrated in the areas of:

- (1) pharmacokinetics, (2) pharmacodynamics, (3) drugs acting on the autonomic nervous system,
- (4) analgetics and local anaesthetics, (5) antipyretics and anti-inflammatory drugs, (6) antibiotics,
- (7) antiviral drugs, (8) antiallergic drugs, (9) drugs affecting respiratory and cardiovascular system,
- (10) antiseptics, disinfectants, preservatives, (11) common systemic side effects of medications, and
- (12) general health.

Subject 20: Pathology and General Medical Disorders

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into general pathology and general medical disorder and how they can affect the eye. Knowledge and understanding should be demonstrated in the areas of:

- (1) inflammation and repair, (2) cardiovascular diseases and the eye,
- (3) blood diseases and the eye, (4) endocrine diseases and the eye, (5) neurological diseases and the eye,
- (6) nutritional disorders, (7) rheumatoid disorders, Vasculitis and Collagenosis, (8) infectious diseases,
- (9) tumours, and (10) congenital and hereditary conditions.

Subject 21: Epidemiology and Biostatistics

Learning outcomes:

The candidates should demonstrate fundamental knowledge and insight into epidemiology and biostatistics, not only for application in laboratory experiments and research, but also for understanding how to interpret clinical evidence in optometric practice. Knowledge and understanding should be demonstrated in the areas of:

- (1) epidemiological data (incidence and prevalence, odds, relative risk, central tendency and variability),
- (2) screening concepts (sensitivity and specificity, predictive value, yield),
- (3) research design, and
- (4) morbidity and mortality.

Subject 22: Ocular anatomy and Physiology

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and explain in detail the anatomy and physiology of the eye.

Knowledge and understanding regarding structure and function, and development and aging, should be demonstrated in the areas of:

- (1) orbita, (2) extraocular muscles, (3) ocular blood supply, (4) ocular and orbital nerves,
- (5) eyelid, (6) eyebrow, (7) conjunctiva, (8) lacrimal system, (9) cornea, (10) sclera,
- (11) anterior chamber and angle, (12) iris, (13) pupil and posterior chamber,
- (14) ciliary body, (15) lens and zonule, (16) choroids, (17) vitreous,
- (18) retina, (19) optic nerve, and (20) visual pathway.

Subject 23: Ocular Pharmacology

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to discuss and manage patients when diagnostic drugs are indicated. Knowledge, understanding and testing skills should be demonstrated in the areas of:

- (1) factors affecting drug absorption, (2) cycloplegics,
- (3) mydriatics, (4) miotics, (5) local anaesthetics, (6) staining agents, (7) antimicrobial agents,
- (8) solutions used in contact lens work, (9) decongestants, antihistamines and anti-inflammatory components, (10) ocular effects of drugs used systemically, (11) first-aid and emergency measures used by the optometrists, and (12) formulation of eye preparations.

Subject 24: Abnormal Ocular Conditions

Learning outcomes:

The candidates should demonstrate knowledge, understanding and skills, and be able to detect and manage patients presenting with abnormal ocular conditions. Knowledge, understanding and detection skills should be demonstrated of ocular pathology affecting: (1) ocular adnexa, (2) lachrymal system, (3) conjunctiva, (4) cornea, (5) sclera and episclera, (6) anterior uvea (iris and ciliary body), (7) papillary, accommodative and refractive pathology, (8) orbit, (9) anterior chamber, angle structure and IOP, (10) lens, (11) peripheral fundus and vitreous, (12) optic nerve and the optic nerve head, (13) fovea, (14) sensory neuro-visual pathology, and (15) oculomotor neuropathology.

Clinical/practical competencis:

- The ability to interpret and investigate the presenting symptoms of the patient.
- The ability to develop a management plan for the investigation of the patient.
- The ability to identify external pathology and offer appropriate advice to patients not needing referral.
- An understanding of risk factors for common ocular conditions.
- The ability to recognise common ocular abnormalities and to refer when appropriate.
- The ability to manage a patient presenting with a red eye.

- The ability to manage a patient presenting with reduced vision.
- The ability to identify abnormal colour vision and to appreciate its significance.
- The ability to manage a patient presenting with cataract.
- The ability to evaluate glaucoma risk factors, to detect glaucoma and refer accordingly.
- The ability to manage a patient presenting with macular degeneration.
- The ability to recognise, evaluate and manage diabetic eye disease and refer accordingly.
- The ability to evaluate and manage a patient presenting with symptoms suggestive of retinal detachment.
- An understanding of the treatment of a range of common ocular diseases.
- The ability to recognise manifestations of systemic disease.
- An understanding of the role of the optometrist in shared care schemes.
- The ability to assess symptoms and signs of neurological significance.
- The ability to manage patients presenting with sight-threatening eye disease.
- An ability to recognise adverse ocular reactions to medication.

Syllabus

Part A: Optics and Optical Appliances

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Subject 2: Physical Optics

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Subject 4: Visual Perception (from summer 2010 this belongs to Part C and is examined in Part C, too!!)

Subject 5: Optical appliances

Subject 6: Occupational optics

Subject 1: Geometrical Optics

Refraction at single spherical or plane surfaces

Curvature and sagitta

Refractive index and rectilinear propagation

Vergence and dioptric power

Object-image relationships, including apparent depth

Ray tracing, nodal point, and nodal ray

Lateral (translinear) and angular magnification

Snell's law of refraction

Thin lenses

Vergence: dioptric and effective power

Object-image relationships

Lateral (translinear) and angular magnification

Thin lens systems

Prismatic effect (Prentice's rule and prism effectivity)

Ray tracing, optical centre, and optic axis

Thick lenses

Cardinal points

Vertex power and equivalent power

Lateral (translinear) and angular magnification

Reduced systems

Aberrations

Spherical

Gama

Oblique astigmatism

Curvature of field

Distortion

Chromatic (longitudinal and lateral)

Higher order aberrations

Apertures

Entrance and exit pupil size and location

Depth of focus, depth of field, hyperfocal distance

Field of view and half illumination

Spherocylindrical lenses

- Location of foci, image planes, principal meridians, and circle of least confusion
- Obliquely crossed spherocylindrical lenses
- Transposition
- Prismatic effect

Thin prisms

- Unit of measurement (prism dioptre)
- Prism deviation
- Combination of thin prisms
- Resolution of an oblique prism into horizontal and vertical components
- Total internal reflection

Mirrors

- Planar and spherical reflection
- Proportion of light reflected from a surface (Fresnel's law)
- Focal power, focal length, and curvature
- Object-image relationships
- Magnification
- Lens / mirror systems
- Ray tracing

Ophthalmic and optical Instruments

- Direct and indirect ophthalmoscopes
- Retinoscope
- Focimeter
- Biomicroscope (Slit-lamp microscope)
- Radiuscope (Microspherometer)
- Keratometer (Ophthalmometer)
- Diagnostic lenses (gonioscopic, fundus, etc.)

Wavefront technology

Subject 2: Physical Optics

Wave optics

- Characteristics of wave motion
- Classifications of the electromagnetic spectrum
- Total and partial coherence
- Diffraction (single slit, circular aperture, limits of resolution, zone plates)
- Interference (double slit, multiple slits, thin film, antireflective coatings, holography)
- Scattering (Rayleigh compared to Tyndall)
- Dispersion

Interaction of light and matter

- Atomic energy levels, absorption and emission line spectra
- Continuous spectra (Black body radiator and gray body radiator characteristics)
- Fluorescence (photons, energy levels)
- Lasers (theory of operation, speckle pattern)
- Spectral transmission

Polarization

- Linearly polarized light
- Circular and elliptical polarization
- Polarization by reflection (glare reduction, Brewster's law)
- Effects of scattering on polarization
- Transmission through successive polarizers (stress analysis, Malus' law)

Image Quality

- Resolving power
- Point and line spread function
- Modulation transfer function (Fourier optics)

Subject 3: Visual Optics

Schematic eye models

- Dioptric components
- Cardinal points, entrance and exit pupils
- Ametropia: far point, near point, correction
- Accommodation: amplitude and effectivity
- Astigmatism, including correction
- Retinal image size, spectacle magnification, and relative spectacle magnification

Dioptrics of the eye

- Characteristics of components (curvature, thickness, separation, refractive indices, and axial length)
- Reference angles and axes
- Catoptric (Purkinje) images
- Retinal image size
- Optical function of the pupil

Quality of the retinal image

- Aberrations (spherical, chromatic, coma, curvature, oblique astigmatism, distortion)
- Diffraction
- St ray light
- Point and line spread functions

Radiation and the eye

- Radiometry (radiant, intensity, radiance, and irradiance)
- Photometry (Luminosity function, luminous intensity, luminance, and illuminance, Lambertian surfaces-cosine laws)
- Spectral transmission of the ocular media
- Retinal illuminance
- Effects of radiation (especially infrared, visible and ultraviolet)

Subject 4: Visual Perception (from summer 2010 this belongs to Part C and is examined in Part C, too!!)

Visual Perception

- Colour perception
- Chromatic discrimination (hue and saturation) for normal defective colour vision
- Colour mixture and appearance
- Colour contrast, constancy, and adaptation
- Colour specification and colorimetry (CIE)
- Spectral sensitivity of normal and defective colour vision
- Mechanisms of colour deficiencies

Space perception

Direction and depth discrimination (monocular and binocular cues, oculocentric and egocentric localization)
Characteristics of sensory function (binocular interactions including summation, binocular suppression and rivalry, corresponding points including horopter criteria)
Development of sensory fusion and binocular vision
Disturbances of perceived direction and distance (aniseikonia and amblyopia)
Sensory-motor interactions (fixation, disparity, past pointing, visually guided behaviour, body posture and perceived orientation, and self-motion)

Form perception

Static visual acuity (including test configuration, various acuity tasks, and factors influencing acuity including blur, intensity and contrast), specification of visual acuity
Spatial contrast sensitivity function (including factors influencing the function)
illusions, constancies, and figure-ground relations
Simultaneous contrast and spatial interactions (Mach bands)

Light perception

Detection characteristics at the absolute light threshold (including spectral, spatial, and temporal aspects)
Brightness-difference thresholds at various adaptation levels (Weber's and DeVries-Rose Laws), specification of contrast
Dark and light adaptation processes and theories
Spatial and temporal summation characteristics (Ricco's, Piper's and Bloch's Laws)

Motion perception

Factors involved in the detection of real and apparent motion, detection of displacements
Motion after-effects
Dynamic visual acuity, visual performances with a moving object, and visual performances with a moving observer

Temporal perception

Critical flicker fusion frequency, including influencing factors (test object size, location and adaption level)
Sub-fusional flicker phenomena (Bartley brightness enhancement)
Successive contrast and masking
Temporal contrast sensitivity function
Stabilised retinal images and monocular suppression (Troxler effect)
Saccadic suppression

Entoptic phenomena

Characteristics and origin of various phenomena (involving the cornea, lens, and vitreous)
Vascular and circulatory phenomena (Purkinje tree, capillary circulation)
Phenomena associated with central vision (Maxwell's spot, Haidinger's brushes)
Phenomena associated with retinal distention or other forms of retinal activity (Moore's lightning streaks, blue arcs of the retina, phosphenes)

Psychophysical Methodology

Basic psychophysical methods and theory

Measurement of absolute and difference thresholds
Methods of limits, adjustment, and constant stimuli

Psychophysical scaling methods and theory

Direct scaling
Indirect scaling

Signal detection methods and theory

Subject 5: Optical appliances

Physical characteristics of ophthalmic lenses

Geometry of lens surfaces (spherical, cylindrical, toric, aspheric)
Lens form
Lens thickness (centre, edge, gradients)
Specification of lens size and shape
Materials (index of refraction, dispersion, hardness, specific gravity)

Optical characteristics of ophthalmic lenses

Locations of and relationships between the optic axis, optical centre, geometric centre, and major reference points
Principles of corrected curve lens design
Verification of lens prescriptions (focimeter, lens measure)
Writing and transposing lens prescriptions
Effect of lens tilt (spheres and spherocylinders about a principal meridian)
Effective power (for near and for changes in vertex distances)

Ophthalmic prisms and prismatic effects of lenses

Thickness differences across a prism
Prismatic effects in the periphery of a lens (spheres, spherocylinders)
Decentration (prism from decentration, decentering to obtain prism, interpupillary distance)
Correction of vertical prism effect
 Slab off (front, back, top, bottom, reverse)
 Double slab off
 Dissimilar segments
 Compensated R segments
 Prism segments
 Multiple corrections
 Fresnel prisms
 Fresnel power additions

Multifocal lenses

Types (fused, 1-piece, progressive power additions and blended lenses)
Methods of producing add powers
Segment centre location
Image movement
Total displacement, horizontal and vertical imbalance
Placement of distance and multifocal optical centre
Optical and physical characteristics of segments (design and calculations, progressive adds, aberrations, surface characteristics)
Specifying multifocal height, size, shape and location of segment

Physical characteristics and biological compatibility of frame materials

Specification and nomenclature of spectacle frame components

Optical and spectacle frame consideration of high-powered lenses: spheric, aspheric, and high index materials

Spectacle magnification

- Shape and power factors
- Iseikonic lens design

Methods of remedying reflections and secondary images

Absorptive lenses

- Specification of lens tints and absorptive coatings (including spectral transmission curves)
- Characteristics of photochromic lenses
- Relationship between lens thickness and spectral transmission
- Special occupational requirements

Impact resistance

- Degrees of resistance of ophthalmic lens materials
- Methods of rendering materials impact resistant
- Methods of verifying impact resistance
- Performance of materials upon impact and after impact
- Specifications of occupational safety lenses

Optical tolerances and physical requirements of ophthalmic lenses and frame materials (EN)

Spectacle Applications

- Spectacle lens prescriptions for ametropia
- Lens problems of aberrations, weight, thickness, limits of field, secondary images, magnification, jump and displacement
- Frame and lens design, including types of single vision and multiple focal lenses, kinds of lens materials, base curves and cylinder forms, character and placement of multi-focals, optical centres, and frame specifications.
- Evaluation of lenses and frames, via focimeter, lens gauge, and observation, for optical centre positioning, powers, and other specifications of design
- Fitting and adjusting frames for the wearer
- Patient counselling information associated with the dispensing of prescriptions for different ametropias

Subject 6: Occupational Optics

Visual Performance

- Visual capability
- Visibility of tasks

Ocular Injuries

- Mechanical
- Non-mecanical

Eye-protection

- Lens materials
- Testing procedures
- Frame material
- Regulations

Lamps and lighting

- Concepts
- Photometric units
- Light sources
- Luminaires
- Lighting design
- Recommendations
- Glare and its control

Visual display units

- Asthenopia
- Facial rash/dermatitis
- Epilepsy
- Radiation
- Regulations

Driving

- Visual function and driving performance
- Visual demands
- Regulations

Part B: Clinical Investigation and Management

Subject 7: Vision and Aging

Subject 8: Refraction

Subject 9: Low vision

Subject 10: Ocular motility and Binocular Vision

Subject 11: Contact lenses

Subject 12: Investigative techniques

Subject 13: Paediatric Optometry

Subject 14: Refractive surgery

Subject 7: Vision and Aging

Human Development

Normal vision development in the infant and child

- Visual acuity
- Contrast sensitivity
- Refractive error
- Colour vision
- Spectral transmission of the ocular media
- Light sensitivity
- Form reproduction and perception
- Accommodation and convergence
- Stereopsis

Normal motor development in the infant and child

- Gross motor/language developmental milestones
- Oculomotor system
- Visual perceptual-motor abilities

Normal cognitive and social development in the infant and child

Effects of early environmental restrictions

- Plasticity of the system
- Animal model
- Light and pattern deprivation
- Monocular and binocular deprivation
- Refractive error
- Cataract
- Strabismus

Normal changes in vision with ageing

- Visual acuity
- Contrast sensitivity
- Refractive error
- Colour vision
- Spectral transmission of the ocular media
- Light sensitivity
- Glare (disability and discomfort)
- Dark adaptation, glare recovery
- Visual fields
- Critical flicker fusion frequency
- Accommodation and convergence
- Oculomotor system

Anomalies of Child Development

Epidemiology; history and signs/symptoms manifest by patients in the age ranges noted

Clinical techniques and tests to assess the development of children at various ages

- Physical status
- Fine and gross motor development
- Personal-social development
- Speech-language development

Clinical characteristics of children who deviate from normal patterns of development, and epidemiology of developmental disorders

- Mental abilities
- Sensory abilities (vision and hearing handicaps)
- Neuromuscular and physical abilities
- Personal-social behaviours
- Speech and language abilities
- Multiple handicaps
- Specific learning disabilities

Tests that diagnose vision problems which may be associated with deviations from normal patterns of development

- Mental abilities
- Sensory abilities (vision and hearing handicaps)
- Neuromuscular and physical abilities
- Personal-social behaviours
- Speech and language abilities
- Multiple handicaps
- Specific learning disabilities

Tests used by optometrists to determine a child's level of visual-perceptual development

- Visual attention and discrimination
- Visual-motor integration
- Intersensory integration
- Bilateral integration and laterality

Role of the optometrist and other disciplines in screening, evaluating, managing and referring children who deviate from normal patterns of development

- Mental abilities
- Sensory abilities (vision and hearing handicaps)
- Neuromuscular and physical abilities
- Personal-social behaviours
- Speech and language abilities
- Multiple handicaps
- Specific learning disabilities

Anomalies of the Ageing Adult

Clinical characteristics of changes in perceptual function (non-visual) associated with ageing

- Hearing
- Coordination
- Cognition
- Social status

Symptom profiles, clinical procedures, and tests identifying changes in vision function of the ageing patient

Clinical management of ageing patients with multisensory loss

Assessment of the need for referral and consultation with other disciplines

Anomalies of Colour Vision (Congenital, Inherited)

Colour vision anomalies by type and prevalence

- Anomalous trichromacy
- Dichromacy
- Monochromacy

Colour vision tests used for both screening and diagnosis of congenital colour vision anomalies

- Pseudoisochromatic tests
- Arrangement tests (Farnsworth Panel 0-15, Farnsworth-MunseI1100-Hue)
- Anomaloscopic matching

Conditions for colour vision testing

Societal implications of colour vision anomalies

- School
- Vocational requirements
- Patient interest

Patient management strategies

- Counselling
- Special aids

Anomalies of Child Development

Clinical characteristics of children who deviate from normal patterns of development, and epidemiology of developmental disorders:

- Sensory abilities (vision and hearing handicaps)

Tests that diagnose vision problems which may be associated with deviations from normal patterns of development:

- Sensory abilities (vision and hearing handicaps)

Tests used by optometrists to determine a child's level of visual perceptual development

- Visual attention and discrimination
- Visual-motor integration
- Intersensory integration
- Bilateral integration and laterality

Age-Related Changes

Symptom profiles, clinical procedures, and tests identifying changes in vision function of the ageing patient

Clinical management of ageing patients with multisensory loss

Assessment of the need for referral and consultation with other disciplines

Subject 8: Refraction

Visual Optics

Refractive state of the eye

- Emmetropia
- Myopia
- Hyperopia
- Astigmatism
- Anisometropia and aniseikonia
- Accommodation
- Aphakia and pseudophakia
- Empty field and night myopia

Mechanisms of presbyopia

- Effects of ageing on the ciliary muscle and accommodation

Human Development

Normal changes in vision with ageing

- Accommodation and convergence

Anomalies of Refraction/Ametropia

Epidemiology, history and symptoms

Observation and recognition of clinical signs, and techniques and skills including determination of:

- Interpupillary distance
- Visual acuity
- Objective static and dynamic refractive status, including automatic refractive devices
- Standard subjective refraction procedures, including astigmatic diais, crossed cylinders, stenopaic slit, fogging methods and equalisation (duochrome) techniques
- Binocular subjective refraction procedures, including accommodation binocular balancing methods
- Cycloplegic subjective and objective techniques
- Automatic computer assisted subjective procedures, laser refraction and variations in procedures for the various ametropias

Identification, treatment and management using spectacle and contact lenses and prognosis

Anomalies of Refraction/ Presbyopia

Epidemiology, history and symptoms

Observation and recognition of clinical signs, and techniques and skills for determining the near add including:

- Amplitude of accommodation
- Crossed cylinders
- Trial lenses
- PRA/NRA

Identification, treatment and management with spectacle and contact lenses and prognosis

Anomalies of Refraction/Aphakia and Pseudophakia

Epidemiology, history and symptoms

Observation and recognition of clinical signs and phenomena associated with aphakia and pseudophakia:

- Magnification
- Field of view
- Spatial distortion
- Convergence requirements
- Sensitivity to glare and techniques

Skills for determining, evaluating and/or verifying:

- Types and characteristics of intraocular lenses and aphakic spectacle and contact lenses
- Intraocular lens power
- Special refraction techniques
- Lens prescriptions for aphakia

Diagnosis, treatment and management with spectacle and contact lenses and prognosis

Anomalies of Refraction/Aniseikonia

Epidemiology, history and symptoms

Observation and recognition of clinical signs, and techniques and skills including:

- Detection of aniseikonia
- Measurement of aniseikonia

Identification, treatment and management with spectacle and contact lenses and prognosis

SUBJECT 9: LOW VISION

Defining low vision

Disorder, impairment, disability and handicap
WHO definitions

Incidence and causes

Prevalence
Causes
Visual impairment in children

Measuring visual performance

Acuity
Contrast
Glair and its effect
Reading
Quality of life

Magnification

Increasing object size
Decreasing viewing distance
Real image magnification
Telescopic magnification

Non-optical aids

Illumination and lighting

Aids for peripheral field

Eccentric viewing and Steady eye strategy

Environmental modification

Clinical procedures

The initial assessment
Examination routine
Prescribing
Training

Subject 10: Ocular motility and Binocular Vision

General ocular motility (Ocular motility)

The intraocular musculature (iris and ciliary)

Purposes and roles for vision
Dynamics of muscle action
Biomechanics and neurological control of pupillary reflexes and accommodation
Interrelationships between pupillary changes, accommodation, and convergence (the near reflex)
Factors affecting pupil size

~~ENTHOUSIA~~
Purpose and roles for vision
Dynamics and kinematics of eye movements
Specification of direction of gaze and ocular orientation (torsion)
Agonist-antagonist relationships
Primary action, and secondary and tertiary actions
Fields of action

Characteristics and control of the various eye movements

Reflex eye movements, including compensatory movements
Small eye movements associated with steady fixation
Versional eye movements (pursuits and saccades)
Vergence eye movements (tonic, accommodative including models of accommodative / vergence interaction, fusional, and proximal)

Sensory Anomalies of Binocular Vision/Strabismus

Epidemiology, history and symptom inventory

Observation and recognition of clinical signs and techniques and skills to test monocular fixation

Amblyopia
Sensory fusion and stereops
Fixation disparity
Anomalous correspondence
Suppression

Identification, treatment and management procedures, and prognosis

Spectacle and contact lens applications, including prisms
Vision therapy

Anomalies of Eye Movements and Ocular Neuropathology

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills for infranuclear pathology including:

Objective and subjective testing for: comitancy and incomitancy
Deviations and measurements thereof
Diplopia
Motor fusion
Paralytic syndromes
Nystagmus
Phorias (Dissociated - Associated)

Identification, treatment and management of eye movement anomalies, and prognosis

Spectacle and contact lens applications, including prisms
Vision therapy

Anomalies of Accommodation and Accommodative Vergence

Epidemiology, history and symptom inventory

Observation and recognition of clinical signs, and techniques and skills to test:

- Amplitude range, facility of accommodation
- Analysis of accommodation and vergence relationships

Identification, treatment and management of accommodation and accommodative vergence anomalies, and prognosis

- Spectacle and contact lens applications, including prisms and AC/A applications
- Vision therapy

Subject 11: Contact lenses

Anomalies of Refraction/Ametropia

Observation and recognition of clinical signs, and techniques and skills including determination of:

- Corneal curvature and thickness

Contact Lens Applications

Treatment and management of refractive/oculomotor/sensory integrative conditions using contact lenses

Lens types and materials:

- Hard lenses
- Haptics
- Lathecut
- Moulded
- Spincast soft lenses

Optics of contact lenses:

- Curves
- Zones
- Widths and tear lens effects
- Sagittal depth
- Centre and edge thickness
- Flex
- Asphericity and toric designs
- Quadrantic specific designs
- Oblique geometries with reverse curves

Theories and methods of fitting:

- Lens design
- Specifications of orders
- Lens verification and evaluation
- Insertion and removal techniques
- Design of wearing schedules
- Fluorescein evaluation and fitting criteria

Patient selection based upon:

- History
- Analysis of primary care data
- Correlations of data
- Facial physiognomy
- Contraindications
- Management based upon education
- Patient handling and control

The examination of a new prospective contact lens patient including

- History
- Anterior segment examination
- Measurement of anterior segment

Contact lens selection from presently available types and forms of lenses**Care of lenses:**

- Handling
- Cleaning
- Preservatives available
- Disinfection methods
- Solutions

Follow-up care

- Adaptation
- Physiologic and post-fitting complications
- Allergic responses
- Lens changes
- Mechanical problems

Bifocal and astigmatic contact lenses:

- Types
- Basis of selection and adaptation
- Techniques of fitting

Specially designed lenses and fitting procedures for:

- Keratoconus
- Irregular corneas
- Keratoplastic
- After refractive surgeries
- Sports vision
- Diseased and traumatic corneas
- Cosmetic (prosthetic) use
- Iris colour changes
- Colour vision deficiencies

Specially designed lenses and fitting procedures for orthokeratologic**Parameter modification in theory and practice****Wavefront technology and contact lenses**

Subject 12: Investigative techniques

Colour Vision investigation

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Keratometry

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Retinoscopy

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Automatic objective refraction

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Slit lamp examination

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Tonometry

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Direct ophthalmoscopy

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Monocular indirect ophthalmoscopy

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Binocular indirect ophthalmoscopy

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Gonioscopy

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Lacrimal system evaluation

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Fundus biomicroscopy

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Quantitative perimetry

- Clinical use
- Instrumentation
- Clinical procedure
- Clinical implications

Subject 13: Paediatric Optometry

Paediatric communication

Assessment of visual acuity

Refractive examination

Myopia

- Prevalence
- Progression
- Management

Binocular vision disorders

- Aetiology
- Pathophysiology
- Clinical characteristics
- Clinical investigation
- Diagnosis
- Management

Paediatric eye disorders

- Genetics
- Cataract
- Retinopathy
- Visual dysfunction
- Congenital
- Neuromuscular

Spectacle dispensing

Paediatric contact lenses

Low vision assessment and management

Subject 14: Refractive surgery

Biology and biomechanics of corneal refractive surgery

- Corneal wound healing
- Munnerlyn's formula

Referrals

- Absolute and relative general health contraindications
- Absolute and relative ocular health contraindications

Pre-operative assessment

- History and symptoms
- Vision assessment (high and low contrast)
- Ocular examination
- Pachymetry
- Keratometry
- Topography
- Tomography
- Pupillometry
- Wavefront aberrometry

Patient counselling

- Patient expectations: dispelling the myths
- Vision after treatment
- Risks and complications
- Informed Consent

Precautions

- Ectasia
- Corneal dystrophies
- Keratitis

Treatment options

- Incisional keratotomy (RK, AK)
- Surface ablation: Photorefractive Keratectomy (PRK) and Laser epithelial keratomileusis (LASEK)
- Laser in-situ keratomileusis (LASIK)
- Clear lens extraction and intraocular lens (IOL) implant
- Phacic intraocular lens implant
- Implantable contact lens (ICL)
- Intrastromal corneal implants

Postoperative assessment

- follow-up schedule
- typical symptoms
- vision assessment
- ocular examination
- typical early postoperative signs

Postoperative complications

- Keratitis
- Diffuse lamellar keratitis
- Steroid response and elevated IOP
- Haze and regression
- Microkeratome-related and other flap related complications
- Dry eye and neurotrophic epitheliopathy
- Epithelial ingrowth
- Visual complications
- Ectasia

Postoperative care

- Discharge criteria
- Considerations for retreatment

Part C: Biological and Medical Sciences

Subject 15: Anatomy and Histology

Subject 16: Neuroscience

Subject 17: General Physiology and Biochemistry

Subject 18: General Microbiology and Immunology

Subject 19: General Pharmacology

Subject 20: Pathology and General Medical Disorders

Subject 21: Epidemiology and Biostatistics

Subject 22: Ocular anatomy and Physiology

Subject 23: Ocular Pharmacology

Subject 24: Abnormal Ocular Conditions

Subject 15: Anatomy and Histology

Head

- Skull
- Muscles of facial expression
- Superficial and deep arteries, veins and lymphatics
- Peripheral cranial nerve distribution
- Paranasal sinuses
- Ear and vestibulum

Cells

- Cell membrane
- Cell compartments
- Cell organelles
- Stem cells and cell differentiation

Tissues

- Epithelium
- Glands
- Connective tissue
- Muscle
- Blood and blood vessels
- Nerve

Subject 16: Neuroscience

Electrophysiology of the nerve cell

- Resting and action potential
- Synapses
- Receptors

Neuroanatomy

- Brain
- Cranial nerves
- Spinal cord
- Autonomic nervous system

Neurophysiology

- Reflexes
- Pain and pain sensation
- Vestibular system, proprioceptive sensations
- Autonomic nervous system

Subject 17: General Physiology and Biochemistry

General Physiology

Respiration

Gastrointestinal activity

Muscles

Body fluids

Renal system

Circulatory system

Endocrine system

General Biochemistry

Proteins

- Structure
- Types
- Enzymes
- Collagen

Carbohydrates

- Structure
- Mono- and polysaccharides
- Glycosaminoglycans and Proteoglycans
- Mucins
- Glycogen

Lipids

- Structure
- Fatty acids, triacylglycerols, sphingolipids, phospholipids, cholesterol
- VDL and HDL cholesterol
- Steroid hormones
- Membrane biochemistry

Molecular Biology

- DNA, RNA
- Genetic code
- DNA replication
- Protein synthesis

Bioenergetics

ATP and ADP
Free energy
Glycolysis
Krebs cycle
Oxidative phosphorylation
Role of oxygen

Subject 18: General Microbiology and Immunology**General Microbiology****Virology**

Structure and morphology
Classification
Viral diseases
Immunity
Laboratory diagnosis

Bacteriology

Structure and morphology
Gram staining
Anaerobic and aerobic bacteria
Physiological processes of bacterial growth
Bacterial diseases
Pathological mechanisms of bacterial infection
Immunity
Laboratory diagnosis

Mycology

Biology of fungi
Mycotic diseases
Laboratory diagnosis

Parasitology

Acanthamebia
Toxoplasma
Onchocercus
Toxicariasis
Phthiriasis

General Immunology

Antigens and antibodies

Complement system

Non-specific immunity

Specific immunity

Hypersensitivity responses

- Anaphylactic hypersensitivity
- Cytotoxic hypersensitivity
- Complex-mediated hypersensitivity
- Delayed hypersensitivity

Autoimmunity

Subject 19: General Pharmacology

Pharmacokinetics

Pharmacodynamics

Drugs acting on the autonomic nervous system

- Cholinergic agonists and antagonists
- Adrenergic agonists and antagonists

Analgetics and local anesthetics

Antipyretics and anti-inflammatory drugs

Antibiotics

Antiviral drugs

Antiallergic drugs

Drugs affecting respiratory and cardiovascular system

Antiseptics, disinfectants, preservatives

Common systemic side effects of medications

General health

- History with regards to differential diagnosis of fatigue, weight, loss, fever headache, dizziness and malnutrition
- Deviations from physical development norms
- Principle of basic cardiac life-support

Subject 20: Pathology and General Medical Disorders

Inflammation and repair

Cardiovascular diseases and the eye

- Hypertension
- Atherosclerosis
- Carotis stenosis
- Aneurysma
- Stroke

Blood diseases and the eye

Anemia
Leucemia
Lymphoma

Endocrine diseases and the eye

Diabetes
Grave's disease and endocrine orbitopathy

Neurologic diseases and the eye

Headache
Multiple sclerosis
Brain tumors
Intracranial pressure
Neuromuscular diseases

Nutritional disorders

Malabsorption
Alcoholism
Vitamin deficiencies

Rheumatoid disorders, Vasculitis and Collagenosis

Rheumatoid polyarthritis
Morbus Bechterew
Reiters Syndrome
Sjogren Syndrom
Giant cell arteriitis

Infectious diseases

Viral diseases
Bacterial diseases
Fungal diseases
Parasitic diseases

Tumours

Brain tumours and vision
Ocular metastasis of primary tumours

Congenital and hereditary conditions

Symptoms and signs of common genetic disorders
Symptoms and signs of common congenital disorders (foetal alcohol syndrome, rubella, syphilis, toxoplasmosis)

Subject 21: Epidemiology and Biostatistics**Epidemiological data**

Incidence and prevalence
Odds ratio
Relative risk
Indices of health
Measures of central tendency and variability

Screening concepts

- Sensitivity and specificity
- Predictive value
- Yield

Major epidemiological studies

Research design

- Descriptive and experimental studies
- Case-control studies
- Cross-sectional studies
- Cohort studies (prospective and retrospective)

Morbidity and mortality

- General morbidity and mortality patterns
- General distribution of eye and vision disorders
- Legal blindness (age-specific causes, age-specific rates)

Subject 22: Ocular anatomy and Physiology

Anatomy of the Eye, Ocular Adnexa and Visual Pathway

Orbit

- Location of bones and openings
- Anatomical relationships among orbital structures (extraocular muscles, nerves, blood vessels, fat compartments, fascia)

Extraocular muscles

- Names, origins, insertions
- Innervation, blood supply

Ocular blood supply

- Branches of internal and external carotid arteries related to the orbit, eyelid and upper face
- Branches of the internal and external jugular veins
- Dural sinuses

Ocular and orbital nerves

- Intracranial and extracranial course, branches and functions of cranial nerve I, III, IV, V, VI, VII
- Parasympathetic and sympathetic nerves (course, branches, tissue innervated)

Eyelid

- Structures of layers, muscles and glands
- Blood supply and drainage, lymphatic drainage
- Innervation

Eyebrow (structure and function)

Conjunctiva

- Structure of layers, cell types, glands
- Blood supply and drainage, lymphatic drainage
- Innervation
- Composition of plica semilunaris and caruncle
- Relationship with adjacent structures

Lacrimal system

- Lacrimal gland (structure, innervation, blood supply)
- Accessory lacrimal glands (location, function)
- Composition and structure of the tear film
- Drainage of tears
- Location of lacrimal fossa and nasolacrimal canal

Cornea

- Normal dimensions
- Temperature
- Composition and ultrastructure of epithelium, Bowman's membrane, stroma, Descemet's membrane and endothelium
- Innervation
- Wound healing and regeneration

Sclera

- Dimensions and colour
- Relationship to adjacent structures
- Composition of layers
- Location and content of emissaria
- Structure of lamina cribrosa

Anterior chamber and angle

- Shape and dimensions
- Composition and ultrastructure of the trabecular meshwork, juxtacanalicular tissue, Schlemm's canal, the scleral spur and Schwalbe's ring

Iris

- Dimensions, zones and coloration
- Composition and ultrastructure of anterior border, anterior epithelium, stroma and posterior epithelium
- Composition and ultrastructure of Sphincter and dilator muscles
- Blood supply, venous drainage
- Innervation

Pupil and posterior chamber

- Locations and dimensions

Ciliary body

- Dimensions and relationship to adjacent structures
- Locations and components of pars plana and pars plicata
- Ultrastructure of the epithelium and stroma and the Ciliary muscle
- Blood supply and venous drainage
- Innervation

Lens and zonule

- Ultrastructure and composition of capsule, epithelium and cortex
- Location of nuclei and sutures

Choroid

- Extent and thickness
- Ultrastructure of Choriocapillaris
- Composition of stroma
- Blood supply, venous drainage
- Innervation
- Location and composition of Bruch's membrane

Vitreous

- Composition, ultrastructure, volume and shape
- Attachments to retina and lens (ultrastructure)
- Locations of patellar fossa, anterior and posterior hyaloids
- Location and origin of hyaloid canal

Retina

- Components and ultrastructure of each layer
- Relationship between retinal pigment epithelium and Bruch's Membrane and photoreceptor outer segments
- Synaptic connections within retina
- Location, names and function of glial cells
- Blood supply, venous drainage
- Location, size and ultrastructure of area centralis, parafovea, fovea, foveola, macula lutea, ora serrata

Optic nerve

- Composition and blood supply of the prelaminar, laminar and retrolaminar portion
- Location of central retinal artery and vein
- Normal surface and optic disc/cup features

Visual pathway

- Localisation of retinal fibres along visual pathway, optic nerve, chiasm, optic tract, lateral geniculate body, optic radiations, visual cortex
- Layers of lateral geniculate body
- Layers of visual cortex, areas
- Blood supply
- Anatomy related to visual pathology

Ocular and Visual Pathway Development

Orbit

- Development of bones, closure of sutures, abnormalities

Extraocular muscles

- Tissue origin and development
- Motor innervation development
- Late development

Eyelid

- Tissue origin and development
- Ectodermal and mesodermal derivatives

Conjunctiva

Tissue origin and development

Lacrimal apparatus

Tissue origin of lacrimal glands (main, accessory)

Appearance of tearing and weeping (reflexes)

Tissue origin of lacrimal and nasal passages

Cornea

Tissue origin and development

Origin and development of nerves

Factors affecting corneal size, curvature, transparency

Sclera

Tissue origin and development

Anterior and posterior chamber

Creation of anatomical space and angle

Factors that promote growth of anterior chamber

Differentiation of Canal of Schlemm, scleral spur, trabecular meshwork

Endothelial membrane

Iris/Pupil

Tissue origin and development

Development of dilator and sphincter muscles

Pupillary membrane

Cilioiridic circulation

Ciliary body

Tissue origin

Development of pars ciliaris retinae

Development of ciliary processes, ciliary muscles, ciliary vessels

Lens and zonules

Tissue origin and development

Effect on development of vitreous, iris, cornea, retina

Mechanism of lens fibre orientation

Stages of lens vesicle and lens fibre development

Developmental nuclei

Zones of development of lens epithelium

Choroid

Tissue origin

Development of choroidal vasculature and Bruch's membrane

Vitreous

Tissue origin and characteristics of primary, secondary and tertiary vitreous

Retina

Development of optic cup

Analogies between development of retina and central nervous system

Formation and fusion of foetal fissure

Retinal and macular differentiation

Retinal circulation development

Postnatal events

Optic nerve and visual pathway

Developmental of lower visual pathway

Myelination

Relationship between development of upper visual pathway and central vision.

Ocular Physiology/Neurophysiology

Circulation

Haemodynamic patterns (resistance, trans mural pressure, flow rate, critical closing pressures)

Autoregulation

Autonomic nervous system control

Unique environment of the eye (high extravascular pressure)

Uveal blood flow: choroid, ciliary body, iris (unique characteristics of each, functions of each)

Retinal blood flow (unique characteristics, dual supply, functions)

Eyelids

Blink reflexes and protective functions

Role in production, distribution and drainage of tears

Tears

Physical characteristics

Functions of tears

Source and function of each layer of tears

Basic and reflex tear secretion

Cornea

Physical characteristics (water content, protein content, cells, resistance to trauma)

Permeability characteristics of various layers

Metabolic characteristics of various layers

Factors influencing corneal thickness/hydration and theories of transparency

Physiological parameters, necessary to maintain corneal integrity

Physiological characteristics of corneal nerves

Ageing changes of the cornea

Intraocular pressure

Mean values and diurnal variation

Association to corneal thickness

Factors controlling aqueous production and outflow

Nervous system regulation of IOP

Systemic factors influencing IOP

Aqueous

Functions of aqueous

Physical characteristics

Formation (ultrafiltration, active transport)

Factors influencing rate of flow

Composition

Blood aqueous barriers (location, ultrastructure, function)

Lacrimal apparatus

Regulation of basic and reflex tear secretion

Pupillary pathways

- Sympathetic and parasympathetic pathway to iris
- Functional relationships between pupillary pathways and central nervous system

Lens

- Function and Physical characteristics
- Metabolism
- Lens proteins
- Theories of transparency
- Regeneration
- Ageing changes in composition

Choroid

- Functions
- Physiological relationships with retina

Vitreous

- Function and physical characteristics
- Metabolism
- Ageing changes in composition

Retina

- Composition and formation of disc outersegments
- Composition and formation of visual pigments
- Stages of visual cycle
- Photoreceptor electrophysiology
- Retinal neurotransmitters
- Function of bi polar, horizontal, amacrine and ganglion cells (receptive fields)
- Retinal neural mechanisms of colour vision (spatial, temporal and chromatic)

Visual pathway

- Function of lateral geniculate body
- Receptive fields of cells in lateral geniculate body (relationship to colour vision, binocularity, grace perception, etc.)
- Function of visual cortex
- Receptive field properties (single cell properties)
- Functional organisation of visual cortex
- Physiology of binocular vision
- Mechanism of feature detection

Extraocular muscles

- Visual-vestibular interactions (vestibulo-ocular reflex, optokinetic reflex)
- Supranuclear control of eye movements.

Subject 23: Ocular Pharmacology

General Principles

- Factors affecting ocular drug bioavailability
- Routes of ocular drug administration

Autonomic Drugs

- Functional concepts and ocular receptor types
- Ocular cholinergic agents
- Ocular adrenergic agents

Properties of topical ocular anaesthetics non-injectable)

Antihistamines

Anti-inflammatory agents

Steroids

Non-steroids (including mast cell stabilizers)

Chemotherapeutic Agents

Antimicrobials

Antivirals

Antifungals

Dyes

Topical diagnostic agents

Oral and intravenous agents

Hyperosmotic agents

Topical ocular agents

Lubricants and tear substitutes

Preparations used with contact lenses

Toxicology

Ocular effects from topical ocular drug administration

Ocular effects from systemic drug administration

Systemic effects from ocular drug administration

Subject 24: Abnormal Ocular Conditions

Ocular Adnexa

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

Palpation of relevant structures

Lid eversion

Diagnosis and management of marginal lid disease

Tonus and strength testing of facial and lid muscles by the third and seventh cranial nerves

Tests for integrity of the fifth cranial nerve

Sinus evaluation (history, discharge, fever, etc.)

Biomicroscopic appearance of relevant structures in health and disease

External photography and documentation

Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Lacrimal System

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Palpation of sac, canaliculi, and lacrimal fossa; observation of lid dynamics, punctal position
- Biomicroscopic appearance
- Use of fluorescein and rose Bengal dyes
- Tests of basic and reflex secretion
- Fluorescein transit tests to nose and oropharynx
- Saccharin taste test
- Signs and symptoms of related systemic diseases
- Qualitative & quantitative tear assessment
- Punctal dilation; probing and lacrimal syringing
- Collagen punctum plugs
- Punctum/canalicular occlusion

Pathophysiology, diagnosis, management options, and prognosis

Conjunctiva

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Biomicroscopy to highlight and describe morphology and location of irregularities, deposits, opacities, etc.
- Evaluation of preauricular and submandibular lymph nodes
- History and evaluation of oropharynx for associated upper respiratory illness
- History related to associated urinary tract infection
- Biomicroscopic appearance of varied appearance of the lids and cornea in primary conjunctival disease
- Swabbing, scraping; smears, stains and cultures
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Differential diagnosis of viral, bacterial and allergic conjunctivitis

- Treatment of conjunctivitis

Evaluation of regional lymph nodes

Cornea

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Biomicroscopy to highlight and describe morphology and location of irregularities, deposits, opacities, etc.
- Evaluation of surface optical quality and abnormal curvature via reflections
- Corneal aesthesiometry and pachometry
- Use of anaesthetics/vital dyes
- Obtaining and interpreting smears and cultures
- Slit-lamp photography
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Sclera / Episclera

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Investigation of entities producing pain in or referred to eye or orbit
- Biomicroscopic techniques useful to detect episcleral and scleral inflammation deep to conjunctival injection/chemosis
- Indirect ophthalmoscopy to detect posterior scleritis
- Signs and symptoms of related systemic disease
- Use of topical vasoconstrictor

Pathophysiology, diagnosis, management options, and prognosis

Anterior Uvea (Iris and Ciliary Body)

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Biomicroscopy
- Gonioscopy
- Transillumination in albinoids
- Evaluation of pupil
- Binocular indirect ophthalmoscopy, with scleral depression
- Referral criteria for special tests
- Slit-lamp photography
- Signs and symptoms of related systemic disease
- Pathophysiology, diagnosis, management options, and prognosis

Pupillary, Accommodative and Refractive Pathology

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Evaluation of the sympathetic pathway
- Evaluation of the parasympathetic pathway and surrounds in third nerve disease
- Relevant pharmacology: including diagnostic tests in Adie's and Horner's syndromes; testing for a pharmacologically blocked pupil as well as the effects of autonomically active drugs and toxicology of accommodative paresis, spasm and ciliary body oedem
- Swinging flashlight and pupil cycle tests
- Evaluation and recognition of signs of aberrant regeneration
- Evaluation of deep tendon reflexes in Aide's syndrome
- Evaluation of suspicious refractive shifts
- Signs and symptoms of - related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Orbit

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Assessment of asymmetrical fissures
- Recognition of dysplastic craniofacial appearance
- General workup for periorbital ache/pain of unknown cause
- Exophthalmometry
- Palpation of orbital rim and anterior orbit
- Evaluation of episcleral venous dilation
- Assessment of periorbital oedema
- Testing for orbital bruits
- Valsalva maneuver in proptosis
- Workup for suspected blow out fracture
- Tests for restrictive myopathy
- Special tests including tomograms, ultrasound, GT- scan, venograms
- Signs and symptoms of related systemic diseases.

Pathophysiology, diagnosis, management options, and prognosis

Anterior Chamber, Angle Structure and Abnormal IOP

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs and techniques and skills including:

- Tensions
- Biomicroscopic appearance of associated anterior segment signs of glaucomas
- Tests for estimation of chamber depth
- Gonioscopy, direct and indirect
- Estimating ocular rigidity with Shiotz tonometer
- Assessment of post surgical eyes
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Lens/Aphakia/Pseudophakia

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Lens toxicology
- Biomicroscopy
- Ophthalmoscopy
- Retinal integrity testing with opaque media
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Direct ophthalmoscopy
- Indirect ophthalmoscopy
- Family history
- Biomicroscopy with fundus lenses
- Ophthalmodynamometry
- Colour vision testing
- Photo stress testing
- Amsler grid testing
- Visual fields
- Dark adaptometry
- Contrast sensitivity testing
- Retinal photography
- Basic interpretation of special studies (EOG, ERG, VER, intravenous fluorescein angiography, ultrasound)
- Retinal integrity testing with opaque media
- Signs and symptoms of related systemic diseases

Methods to assess retinal function in presence of corneal irregularity and media opacities

Peripheral Fundus/Vitreous

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Binocular indirect ophthalmoscopy, scleral depression and retinal drawing
- Biomicroscopy with peripheral fundus lenses
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Optic Nerve Pathology

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Nerve toxicology
- Colour vision testing in optic nerve disorders
- Visual field testing
- Testing for objective and subjective afferent papillary defects
- Pupil cycle times
- Pulfrich phenomenon
- Use of neutral density filters
- Interpretation of electrodiagnostic tests, contrast sensitivity, etc.
- Observation of nerve head and peripapillary retina with ophthalmoscope, fundus lenses and stereophotography
- Carotid assessment
- Plain x-rays, tomograms, CT-scan, ultrasound and intravenous fluorescein
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Sensory Neuro-Visual Pathology

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills including:

- Transient neuro-visual episodes
- Detailed visual fields
- Detailed headache workup
- Indications, limitations, risks and costs of intravenous angiography, direct puncture angiography, plain x-rays, tomograms, CT -scan, air studies, EEG, radio-nucleotide scanning, nuclear magnetic resonance scans
- Signs and symptoms of related systemic diseases

Pathophysiology, diagnosis, management options, and prognosis

Oculomotor Neuropathology

Epidemiology, history and symptom inventory

Observation, inspection, recognition of signs, and techniques and skills for infranuclear pathology including:

- Objective and subjective testing for incomitancy
- Strength and fatigue testing in myopathies
- Recognition and examination for orbital signs
- Understanding indications for intravenous tension
- Signs and symptoms of related systemic diseases and observation, inspection, recognition of signs, and techniques and skills appropriate to supranuclear oculomotor neuropathology including:
 - Observation, inspection and testing stability of eyes infixation
 - Testing for adequacy of pursuits
 - Testing for adequacy of saccades
 - Testing of extraocular muscle reflexes
 - Assessment of "dizzy" patient