European Council of Optometry and Optics

The European Qualification in Optics

The Syllabus

October 2017
ECOO QUALIFICATION IN OPTICS
SYLLABUS

Subject 1 – Geometrical Optics

Suggested ECTS / ECVET: 6

Refraction at single spherical or plane surfaces

- Curvature and sagittal
- 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 effects (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

**Sphero-cylindrical lenses**

Location of foci, image planes, principal meridians and circle of least confusion
Obliquely crossed sphero-cylindrical 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 (ophthalmomter)
- Diagnostic lenses (gonioscope, fundus etc)

**Wavefront technology**

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**Subject 2 – Physical Optics**

Suggested ECTS / ECVET: 4

**Wave optics**

- Characteristics of wave motion
- Classification of the electromagnetic spectrum
- Total and partial coherence
- Diffraction (single slit, circular aperture, limits of resolution, zone plates)
- Interference (double slit, multiples 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
- Fluorescence (photons, energy levels)
Lasers (theory of operation, speckle pattern)
Spectral transmission
Light emitting diodes (LED)

**Polarisation**
Linely polarised light
Circular and elliptical polarisation
Polarisation by reflection (glare reduction, Brewster’s law)
Effects of scattering on polarisation
Transmission through successive polarisers (stress analysis, Malus’law)

**Image Quality**
Resolving power
Point and line spread function
Modulation transfer function (Fourier optics)

**Subject 3 – Visual Optics**

*Suggested* ECTS / ECVET: 2

**Schematic eye models**
Dioptic 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

**Dioptics 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

Stray light

Point and line spread functions

**Radiation and the eye**

Radiometry (radiant, intensity, radiance and irradiance)

Photometry (luminosity function, luminous intensity, luminance, illuminance, Lambertian surfaces-cosine laws)

Spectral transmission of the ocular media

Retinal illuminance

Effects of radiation (especially infrared, visible and ultraviolet)

**Subject 4 Optical Appliances**

Suggested ECTS / ECVET: 12

**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 (refractive index, 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 effect of lenses**

Thickness differences across a prism

Prismatic effects in the periphery of a lens (spheres, spherocylinders)

Decentration (prism from decentration, decentring 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, one-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 resistance
Methods of verifying impact resistance
Performance of materials upon impact and after impact
Specification 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 multifocal lenses, types of lens materials, base curves and cylinder forms, character and placement of multifocals, optical centres and frame specifications.
Evaluation of lenses and frames, via focimeter, lens gauge, observation, for optical centre positioning, powers and other specifications of design.
Fitting and adjusting frames for the wearer

Client counselling information associated with the dispensing of prescriptions for different ametropias.

**Subject 5 – Occupational Optics**

Suggested ECTS / ECVET: 2

**Visual Performance**

Visual capability

Visability of tasks

**Ocular Injuries**

Mechanical

Non-mechanical

**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

Section 6 – Methods of Ocular Examinations
Suggested ECVET 3

Auto-refraction
Principles of auto-refraction
Effectiveness and limitations of auto-refraction
Accuracy of use

Visual Field Screening
Principles of visual field screening
Visual field defects and their causes
Benefits and limitations of visual field screening
Accuracy of use

Non contact tonometry
Principles of tonometry
Alternative methods of measuring intra ocular pressure
Advantages and disadvantages of non contact tonometry
The need for intra ocular pressure measurement
Accuracy of use

Fundus photography and ocular coherence tomography (OCT)
Principles of fundus photography and OCT
Advantages and disadvantages of fundus camera and OCT
Accuracy of use

Conditions for which OCT could be beneficial

Slit lamp

Principles of the slit lamp

Uses of the slit lamp

Section 7 – Refractive error

Suggested ECVET 4

Anatomical structures of the eye and their function

Refractive errors

Myopia

Hyperopia

Astigmatism

Presbyopia

Correction of refractive error

Spectacle lenses

Contact lenses

Laser surgery

Interpretation of optical prescriptions

Single vision prescriptions

Bifocal prescriptions

Progressive power prescriptions

Section 8 – Contact Lenses

Suggested ECVET 4

Professional and legal implications of the supply of contact lenses and aftercare

Medical devices directive

Legal requirements/qualifications to fit contact lenses

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After care
Supply of contact lenses

**Contact lens solutions**
Medical devices directive
Different solutions for different types of contact lenses
Supply of solutions

**Design of contact lenses**
Specifications for the fitting of different types of contact lenses
Contact lens materials and advantages and disadvantages
Comparison of different designs, advantages and disadvantages
Medical use of contact lenses

**Wearing modalities**
Different wearing modalities their advantages and disadvantages
Replacement schemes for different materials

**Non-compliance with wearing and care regimes**
Limits of responsibility and authority of non-professional staff
Signs of non-compliance
Consequences of non-compliance
Storage and lens care within the practice
Lens care regimes for different modalities
Insertion and removal of different lens types

**Section 9 – Ocular conditions and emergencies**
Suggested ECVET 4

**Eye Conditions encountered in an optical practice**
Signs and symptoms of common red eye conditions
Aetiology of common red eye conditions
Management of red eye conditions

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Flashes and floaters
Sudden loss of vision
Macula degeneration
Diabetic retinopathy
Strabismus
Amblyopia

Dealing with an ocular emergency

What is an ocular emergency?
Priorities in ocular emergencies
Communication with clients and relatives in ocular emergencies
Referral procedures
Role of non professional staff

Section 10 – Business management

Suggested ECVET 10

Legal and regulatory requirements

Trade descriptions in the optical environment
Employment law
Equal opportunities
Discrimination law
Data protection
Medical devices legislation

Health and Safety

Health and safety regulations applying to an optical practice
Client safety in the practice
Risk assessment
Fire equipment and regulations

Managing staff and performance development

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Responsibilities of staff management

Staff development

Performance management

Appraisal systems

Disciplinary and grievance systems

Customer Service

Principles of customer service

Customer service in an optical environment

Managing complaints and complaint resolution

Managing customer behaviour in difficult situations

Selling in an optical environment

General rules of selling

Challenges in selling

Sales in an optical practice

Factors for success of an optical practice

Demographics

Location

Range of services

Financial planning

Advertising and Promotion

Understanding and evaluating the effectiveness of different marketing techniques

National and professional advertising regulations

Marketing communications and data protection

The role of promotions

Financial management

Price structures (cost price, mark ups, selling price, VAT, overheads, recovery of costs, profit margin)
Stock control
Different payment systems
Basic accounting

**Subject 12 Communication**

*Communication in optical practice*

- Different communication styles and methods
- Advantages and disadvantages of different communication methods
- Addressing concerns of customer and family
- Understanding limitations of responsibility
- Client confidentiality
- Record keeping
- Recall systems

**Subject 13 Professional Conduct**

*Regulatory and professional requirements*

- Regulations controlling eye care and the supply of spectacles and contact lenses
- Responsibilities to clients
- Legal obligations for optical practice
- Quality assurance
- Practice standards
- The role of different eye care professionals