DEPARTMENT OF HEALTH SCIENCES

JUN 2025

BINDURA UNIVERSITY OF SCIENCE EDUCATION
FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF OPTOMETRY
BACHELOR OF SCIENCE HONOURS DEGREE IN OPTOMETR

CANDIDATE NUMBER:

OPTC109: PHYSIOLOGICAL OPTICS I
Duration: 3 HOURS **(100 MARKS)**

INSTRUCTIONS: Attempt **ALL** questions in ALL sections.

SECTION A. Attempt all questions. (50 marks)

In this section there is stem and five responses. Indicate against each response whether is **TRUE** or **FALSE**

1. In the schematic eye of Gullstrand:
   a. the human model eye is based on the principal of thick lenses
   b. the eye is about 24.0 mm in axial length
   c. the nodal points lie on either side of the posterior surface of the lens
   d. the nodal points coincide with the principal points
   e. the cornea contributes 2/3 to the power of the eye

2. In the reduced eye of Listing:
   a. the refractive power is stronger than that of the schematic eye of Gullstrand
   b. the whole eye is regarded as a single refractive surface
   c. the second focal point lies on the retina
   d. the nodal point lies at the posterior surface of the lens
   e. the principal plane lies at the anterior surface of the lens

3. The following definitions are true for accommodation:
   a. the far point of distinct vision of an emmetropic eye is at infinity
   b. the near point of distinct vision refers to clear near vision when maximum accommodation is used.
   c. range of accommodation is the difference in dioptric power between the eye at rest and the fully accommodated eye
   d. dynamic refraction refers to the dioptric power of the accommodated eye
   e. static refraction refers to the dioptric power of a resting eye

4. Regarding accommodative convergence / accommodation ratio:
   a. the eye could not accommodate in the absence of convergence
   b. the normal range of accommodative convergence/ accommodation ratio is 3:1 to 5:1
   c. the interpupillary distance needs to be known if the ratio is to be calculated using the gradient method
   d. the value obtained using the heterophoria method tends to be lower than that calculated using the gradient method
   e. esotropia that occurs as a result of too high an AC/A ratio tends to have a larger angle of deviation for near than for distance.

5. The catoptric images:
   a. are formed at the refracting interfaces of the eye
   b. can be used to measure the ocular accommodation
   c. are all virtual images
   d. are all erect images
   e. are made up of 2 images produced by the cornea and 2 images by the crystalline lens

6. The first image of the captoptric image can be used for:
   a. measuring ocular deviation in strabismic patient
   b. keratometry
   c. measuring accommodation
   d. measuring corneal thickness
   e. measuring anterior chamber depth

7. The following are **true** about cones:
   a. they are taller and thinner in fovea
   b. they are absent in the optic disc
   c. 90% of the cones in the retina is situated outside the central 5 degrees of the macula
   d. the red and green pigments are encoded on the long arm of X chromosome
   e. the chromophore of each cone pigment exists as 11-trans-retinal

8. With regard to the vestibular system:
   a. it is concerned with optokinetic nystagmus
   b. it comprises the semi-circular canals, utricle and saccule
   c. the semi-circular canals respond to linear acceleration of head movement
   d. the utricle responds to rotational acceleration of head movement
   e. the saccule responds to linear acceleration of head movement.

9. The following are involved in vergence eye movements:
   a. conjugate movement
   b. pupillary constriction
   c. accommodation
   d. sympathetic pathway
   e. rapid eye movement

10. The following areas are involved in the initiation of a saccadic eye movement:
   a. inferior colliculus
   b. posterior parietal cortex
   c. frontal eye fields
   d. dorsal prefrontal cortex
   e. temporal cortex

SECTION B. Choose the **most** appropriate option from A-D by circling. **(10 marks)**

10. In the average adult eye, the anterior nodal point N is located

_____

a. in the anterior chamber.
b. near the posterior surface of the crystalline lens.
c. near the anterior surface of the crystalline lens.
d. near the cornea.
e. near the retina.

11. In the average, unaccommodated, emmetropic adult eye, the

_____

a. anterior focal length is longer than the posterior focal length
b. the radius of curvature of anterior cornea surface is longer than the radius for the posterior corneal surface.
c. the radius of curvature of anterior lens surface is shorter than the radius for the posterior lens surface
d. the anterior principal plane is closer to the retina than the posterior principal plane
e. the refractive index of the vitreous is greater than the refractive index of the aqueous.

12. The posterior nodal point of the average adult eye lies?
a. anterior to the front surface of the cornea.
b. within the cornea.
c. within the aqueous.
d. anterior lens.
e. anterior vitreous.

13. What is the axial length of an emmetropic eye that has a power of 65D?
a. 18.3mm
b. 19.2mm
c. 20.5mm
d. 22.9mm
e. 24.2mm

14. The principal planes of Gullstrand's exact eye lie
a. anterior to the front surface of the cornea
b. within the cornea
c. within the aqueous
d. within the lens

15. What happens to the refractive power of the eye if the radius of curvature of the anterior cornea is decreased?
    a. it increases
    b. it decreases
    c. it stays the same
    d. it may increase or decrease. within the vitreous

16. Which of the following changes will produce a decrease in the total optical power of the eye?
    a. decrease the radius of curvature of the anterior cornea
    b. increase the radius of curvature of the posterior cornea
    c. moving the crystalline lens forward toward the cornea
    d. increase the refractive index of the cornea
    e. decrease the refractive index of the cornea

17. All of the following occur when the lens undergoes accommodation except which one?
    A. The anterior lens surface shifts forward into the aqueous towards the cornea.
    B. The posterior lens surface pushes backwards into the vitreous towards the retina
    C. The lens thickness increases.
    D. The nodal planes shift towards the principal planes
    E. The principal planes shift towards the nodal planes

18. How many Purkinje images are there?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

19. The first Purkinje image produced in an unaccommodated eye viewing a distant object is_____
    a. a real, inverted image located near the posterior surface of the lens.
    b. a virtual, erect image located near the anterior surface of the lens.
    c. a virtual, inverted image located in the vitreous chamber.
    d. a virtual, erect image that is larger than all the other Purkinje images.
    e. a real, erect image formed at the eye's secondary focal point.

20. Which of the Purkinje images changes the most when the eye accommodates from distance to near?
    a. Purkinje image I
    b. Purkinje image II
    c. Purkinje image III
    d. Purkinje image IV
    e. None of the PS images changes during accommodation

SECTION C. Attempt **all** questions in this section. **(40 marks)**

1. What Are Entoptic Images? {2 marks}
2. What is the essence of entoptic phenomenon? {6 marks}
3. State **two** characteristics of a physiologic halo. {4 marks}
4. A friend of yours told you he has been diagnosed of vitreous floaters. He/she was worried if her symptoms will disappear anytime soon. What will be your expert response to your friend and why? {4 marks}
5. A Recent-onset, innumerable floaters often are due to? {6 marks}
6. What **two** occurrences are the common reasons for one to experience retinal phosphenes? {4 marks}
7. Why do infants with low vision taught to rub their eyes incessantly? {4 marks}
8. Which type of entoptic phenomenon is associated with posterior vitreous detachment? {2 mark}
9. The Purkinje tree is a good example of how the visual cortex separates self from non-self {4 marks}
10. How the Purkinje Tree is Similar to Posterior vitreous detachment? {4 mark}

END OF PAPER