DIVISION OF VISION SCIENCES

VISUAL OPTICS

VISP102

LEVEL: 1

MODULE LEADER: DR HARRY ORBACH

B.Sc/B.Sc. (HONS) OPTOMETRY

AUGUST 2007

DURATION: 2 HOURS

CANDIDATES SHOULD ATTEMPT FOUR QUESTIONS

PLEASE READ THE QUESTIONS CAREFULLY

Students for whom English is not their first language are permitted to use a
Standard English/Foreign Language dictionary, e.g.
French/English/English/French. Please ensure that the dictionary does not contain
any notes or other materials and note that electronic dictionaries are not
permissible

MATERIALS TO
BE SUPPLIED/ALLOWED:

- Lined Examination Script Books □
- Unlined Examination Script Books □
- Other Materials, e.g. Graph paper, statistical tables (please specify)

- Graph Paper
- Calculator (Allowed but if calculator has full alphabet on keys confiscate)
1. a) Draw a diagram of the retina as seen by an opthalmoscope, with the eye pointing in a direction so that the Purkinje images are lined up as much as possible, showing:

i) the optic disk;  
ii) the fovea;  
iii) the macula;  
iv) intersection of the optic axis with the retina;  
v) intersection of the visual axis with the retina.

Briefly describe each of these, with, if relevant, relation to vision. Also describe the primary function of the retina and describe two differences between the central and the peripheral retina. (10)

b) What is the corresponding visual acuity of letters on the 6/12 line of a Snellen chart.

i) As an Imperial (American) Snellen fraction? (1)  
ii) In minutes of arc? (1)  
iii) In LogMar format? (1)

c) How large, in mm, are these 6/12 letters? (2)

d) List 5 characteristics specified by an international standard on eyecharts. (5)

2. a) Describe and compare the refractive properties of the following lenses:

i) The unaccommodated crystalline lens of a real person.  
ii) The lens modeled in Gullstrand's 'exact' schematic eye.  
iii) The lens modeled in a three surface model eye (i.e. Bennett and Rabbetts). (7)

b) Explain the differences between the Emsley-Rabbetts simplified eye and the reduced eye. Describe the relative advantages and disadvantages with respect to each other. (2)

c) Briefly define and contrast the optical axis and the visual axis of the eye. (1)

d) Using an appropriate diagram, derive an expression for the shape factor component of the magnification produced by a thick lens. (10)
3. a) Define the terms anisometropia and aniseikonia. (5)

b) Assuming a three-surface model of an emmetropic eye filled with a liquid of refractive index 4/3, axial length 24.17 mm and corneal radius 7.8 mm, calculate:

i) the ocular refraction of the eye if the lens has been removed. (10)

ii) the power of a spectacle lens which is needed to correct the aphakic eye if the distance between the lens and the eye is 10 mm. (5)

4. a) State Knapp’s rule and explain the conditions that apply to it. (10)

b) Miss Shawside is fully corrected by contact lenses with the following prescription:

Right & Left back optic zone radius 7.55mm, total diameter 9.40 mm,
BVP -6.50 DS

Keratometry readings:
Right 7.65 @ 180 and 7.40 @ 90 and Left 7.60 @ 180 and 7.50 @ 90
Refractive indices: tears 1.336, contact lens 1.490, cornea 1.376
Thicknesses: Tear film 0.0mm, CL 0.0 mm

i) What would the power of the tear lens be (in air), for each eye? (Show your calculations) (4)

ii) What is the ocular refractive error for this patient? (Show your calculations.) (2)

iii) What is her spectacle refraction, at a back vertex distance of 14 mm? (4)
5. a) An astigmatic reduced eye with a pupil diameter of 3 mm has a power of +64.00D in the 45° meridian and +62.00D in the 135° meridian. Calculate the length of focal lines and the diameter of the circle of least confusion if an axial point object is placed at a distance of 0.5 m in front of the eye's principal point. What are the orientations of the first and second focal lines? (10)

b) Draw (using the standard convention of light travelling from the left to the right) the positions of the focal lines relative to the retina for a refractive error of +1.75 / -2.00 x 20.

Taking this as your starting point, use diagrams and words to describe (in bullet point form) the process of determining the refractive error using the cross-cylinder method of cylinder correction. (10)