

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

NOV 2024

OPTC105 GEOMETRICAL OPTICS

TIME: 3 HOURS

(100 marks)

CANDIDATE NUMBER

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INSTRUCTIONS:

- This paper consists of two sections, A and B. Answer section A on the question paper and Section B in the answer booklet provided

SECTION A. Attempt All questions (40marks) Mark the MOST APPROPRIATE

1. What can of image is created by a concave lens?
A. upright and smaller
B. inverted and smaller
C. inverted and larger
D. upright and smaller

2. An Optometrist prescribes a power -0.50D dioptre. The corresponding lens must be a..?
A. convex lens of focal length 2m
B. convex lens of focal length 50cm
C. concave lens of focal length 2m
D. concave lens of focal length 50cm

3. How far must a girl stand in front of a concave spherical mirror of radius 120cm to see an erect image of her four times natural size
A. 40cm from the mirror
B. 45cm from the mirror
C. 50cm from the mirror
D. 55cm from the mirror

4. How must an object be from a concave mirror if the image formed is to be inverted?
A. less than the focal length
B. exactly at its focal length
C. more than its focal length
D. none of the above

5. An object is kept 5cm in front of a concave mirror of focal length of 15cm. What will be the nature of the image?

- A. virtual, not magnified
- B. virtual, magnified
- C. real, magnified
- D. real not magnified

6. What type of mirror is used in a view finding mirror of a vehicle?

- A. convex mirror
- B. concave mirror
- C. Plane mirror
- D. paraboloidal mirror

1. Which is the brightest image of a candle flame can be seen in a thick mirror?

- A. last
- B. fourth
- C. third
- D. second

2. How many images which are formed in two mirrors at 90° to each other?

- A. two
- B. three
- C. four
- D. six

3. An object placed at distances of 8cm and 12cm from a convex lens on its principal axis forms a real image and a virtual image of the same size respectively. Which is the focal length of the lens?

- A. 15cm
- B. 16cm
- C. 18cm
- D. 20cm

4. Which of the following is incorrect?

- A. A concave mirror can give a magnified virtual image
- B. A concave mirror can give a magnified real image
- C. The virtual image given by a concave mirror is inverted
- D. The real image given by a concave mirror is inverted.

5. Different objects at different distances are seen by the eye. The parameter that remains constant is

- A. the focal length of the eye lens
- B. the object distance from the eye lens
- C. the radii of curvature of the lens

D. the image distance from the eye lens

6. What is the wavelength of the visible spectrum?

- A. 400nm-780nm
- B. 200nm-10000nm
- C. 780nm-1400nm
- D. 400nm-1400nm

7. Which congenital defect occurs if red cone pigment is absent.....?

- A. deuteranopia
- B. protanopia
- C. tritanopia
- D. duochrome

8. The image formed by a prism has all the following characteristics except.....?

- A. erect
- B. virtual
- C. displaced towards the apex of the prism
- D. displaced towards the base of the prism.

9. What is the refractive index of the cornea as part of the optical system of the eye?

- A. 1.00
- B. 1.33
- C. 1.37
- D. 1.386

10. Which of these colors of light is most deviated when white light is passed through a prism.....?

- A. violet
- B. red
- C. blue
- D. green

11. What is the critical angle i at the interface glass-cladding of an optical fiber whose core has a refractive index equal to 1.5 and cladding with a refractive index 1.45?

- A. 15
- B. 86
- C. 83
- D. 75

12. Which of the following characteristics is true about light with a single wavelength?
[I) It can be refracted II) It cannot be dispersed III) It can be reflected]

- A. I, II and III
- B. I and II only
- C. II and III
- D. I and III only.

19. Which of the following characteristics is true about light?

[I) It is an electromagnetic wave II) It does not propagate in vacuum
III) Its maximum speed is approximately 3×10^8 m/s]

- A. I only
- B. I and II only
- C. I and III only
- D. III only

20. The total flow of light emitted in all directions from a source is termed.....?

- A. radiant flux
- B. luminous efficiency
- C. photopic sensitivity
- D. visible spectrum

21. A scuba diver swimming underwater shines a flashlight up out of the water (refractive index 1.33). The beam of light strikes the surface at an angle of incidence of 37 degrees. Is the beam bent towards or away from the normal? What is the angle of refraction?

- A. away, 27 degrees
- B. towards, 53 degrees
- C. towards, 27 degrees
- D. away, 53 degrees

22. The power of lens is?

- A. $1/p$
- B. $1/q$
- C. $1/f$
- D. $1/l$

23. The lens which is thin at center and thick at edges is called?

- A. Convex lens
- B. biconvex lens
- C. biconcave lens
- D. concave lens

24. The lens which diverges light from a single point is.....?

- A. concave
- B. convex
- C. biconvex
- D. all of the above

25. The distance between the optical center and principal focus is.....?
- A. radius
 - B. focal length
 - C. linear length
 - D. 2 focal length
26. A lens which converges the incident rays on a single point is?
- A. convex lens
 - B. concave lens
 - C. biconcave lens
 - D. biconvex lens
27. Where does the principal axis intersect the two refracting surfaces.....?
- A. front vertex and back vertex
 - B. focal length
 - C. radius of curvature
 - D. principal focus
28. If the object is at infinity where and how will the image form?
- A. At $2F$, real, Inverted and same size
 - B. At F , point size, real and inverted
 - C. Between F and $2F$, real, inverted and diminished
 - D. Beyond $2F$, real, inverted and magnified
29. Which is correct for a beam of light passing obliquely from one medium to another.
- A. Refraction
 - B. Dispersion
 - C. Reflection
 - D. Deviation
30. From which parts of the lens, the ray of light passes without deviation?
- A. Optical center
 - B. Focus
 - C. Center of curvature
 - D. Pole
31. When will the convex lens give a real image?
- A. Beyond optical center
 - B. Beyond focus
 - C. Beyond center of curvature
 - D. Between focus and curvature

32. The spherical surface of lens results in

- A. having a wide range of focal length
- B. having a narrow range of focal length
- C. having a wide range of curvature
- D. having a narrow range of curvature

33. Suppose you are standing 1m in front of a plane mirror, what should be the minimum vertical size of the mirror so that you can see your full image in it?

- A. 0.50m
- B. 2m
- C. half your height
- D. twice your height

34. What is the power of the lens, if the far point of a short-sighted eye is 200cm?

- A. -0.5D
- B. 2D
- C. 1 D
- D. -1.5D

35. The image formed by a convex mirror of a real object is larger than the object

- A. when $U < 2f$
- B. when $U > 2f$
- C. for all values of U .
- D for no value of U

36. The mirror used for the head light of a car is.....?

- A. spherical concave
- B. plane
- C. Cylindrical
- D. parabolic concave

37. The ratio of the focal length of the objective to the focal length of the eye piece is greater than one form

- A. a microscope
- B. a telescope
- C. both microscope and telescope
- D. neither microscopic nor telescope

38. The radius of curvature of plane mirror

- A. zero
- B. is infinity
- C. can be anywhere between zero and infinity
- D. none of the above

39. Since the human eye is like a camera, what are the image characteristics?

- A. a straight or upright, real image of the object on the retina
- B. an inverted, virtual image of the object on the retina
- C. an inverted, real image of the object on the retina
- D. a straight or upright, real image of the object on the iris

40. An object is placed at the focus of a concave mirror. The image will be.....?

- A. real, inverted, same size at the focus
- B. real, upright, same size at the focus
- C. virtual, inverted, highly enlarged at infinity
- D. diminished, real and upright

SECTION B. ATTEMPT ALL QUESTIONS. (60 MARKS)

1. A. Explain the types of aberrations related to lenses and how each is corrected? 16marks
B. state the laws of reflection? 4 marks
2. A. State the Snell's law of refraction? 4 marks
B. Outline four principal functions of prisms. 8 marks
C Suppose a ray of light is travelling from air with speed of 3×10^8 from air of refractive index 1 to glass of refractive index 1.523. If the ray strikes the glass at angle of 30 degrees, what will be the angle of refraction and deviation? 8 marks
3. A. Two thin lenses of power of +6D and -2D are in contact. What is the focal length of the combination? 5 marks
B. A converging lens kept co-axially in contact with a diverging lens, both the lenses being of equal lengths. What is the focal length of the combination? 5 marks
C. State the units of prisms 4 marks
D. A certain lens focuses light from an object 2.75m away as an image 48.3cm on the other side of the lens. What type of lens is it and what is its focal length? 6 marks

END OF PAPER