

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：2404 光電工程系碩士班

第三節 光學 試題 (選考)

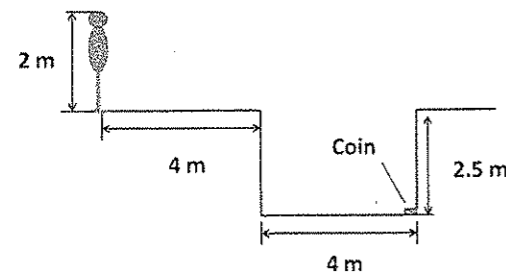
第一頁 共一頁

注意事項：

1. 本試題共九題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (10%) What is the minimum length of mirror required for a person to see his/her full length? Draw a picture to illustrate your answer.

2. (10%) A person of height 2 m stands at a distance of 4 m from the edge of a pool of depth 2.5 m and width 4 m. A coin lies at the bottom at the far side, as shown Fig.1. To what depth must the pool be filled for him to see the coin? (Assume the refractive index of water is 1.33.)



(Fig.1)

3. (10%) A converging lens of focal length 4 cm is placed 12 cm ahead of a diverging lens of focal length -2 cm. A small object is 8 cm in front of the converging lens. Find

- (a) (5%) the position of the final image;
- (b) (5%) the transverse magnification of the final image.

4. (10%) Locate the image of a small object produced by a glass sphere (of refractive index $n = 1.5$) of radius 4 cm given that the object is located in air at 20 cm from the center of the sphere.

5. (10%) Sunlight illuminates a film of oil ($n = 1.25$) on water ($n = 1.33$). In the range 400 - 700 nm, only 483 nm and 621 nm are missing in the reflected light. What is the minimum possible thickness of the film?

6. (10%) One arm of a Michelson interferometer contains a transparent cylinder of length 1.5 cm. The cylinder is evacuated, and the cross hairs of the telescope are centered on a particular bright fringe with light of wavelength 600 nm (in vacuum). When a gas is introduced into it, fourteen fringes move past the cross hairs. What is the refractive index of the gas?

7. (15%) A double slit consists of two slits, each of width 5.3 μm , separated by a distance of 82 μm . Light of wavelength 499 nm is incident on the slits.

- (1) (5%) At what angle will the first diffraction minimum occur?
- (2) (10%) How many interference fringes are contained within the central bright diffraction fringe?

8. (15%) An elliptically polarized light beam given by

$$\vec{E} = \hat{i}E_0 \sin(kz - \omega t) + \hat{j}E_0 \sin(kz - \omega t + \pi/4)$$

passes normally through an ideal linear polarizer whose transmission axis is tilted at 45° in the xy-plane.

- (1) (10%) Write an expression for the emerging beam and describe its state of polarization.
- (2) (5%) Calculate the emerging irradiance.

9. (10%) Light impinges on a metal which has a work function of 2.0 eV, and electrons are emitted with speeds up to a maximum of 6.0×10^6 m/s. (Planck's constant $h = 6.625 \times 10^{-34}$ Js)

- (1) (5%) What is the frequency of the light?
- (2) (5%) What is the minimum frequency of light needed to produce any photoelectrons?