

國立臺北科技大學 101 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 7 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. (20%) A green light beam can be described by the wave equation

$$y = 10^3 \sin[1.18105 \times 10^7 x - 3.54315 \times 10^{15} t + \frac{\pi}{4}]$$

The unit of x and t are meter (m) and second (s), respectively. Find the beam's

- (a) Amplitude (5%)
- (b) Wavelength (5%)
- (c) Period (5%)
- (d) Speed (5%)

2. (15%) Design a large spherical mirror so that when a 24 cm high object is placed 45 cm in front of the mirror, an erect virtual image 16 cm tall is produced.

- (a) Where is the image located? (5%)
- (b) What is the radius of curvature of the mirror? (5%)
- (c) What is the shape of the mirror? (5%)

3. (15%) A retro-reflector is an optical device which reflects light back directly whence it came. One of the retro-reflector is shown in Fig.1 with a solid transparent sphere of index of refraction n and the mirror on the rear of the sphere.

- (a) Calculate the index of refraction n which enable a sphere to retro-reflect light. (10%)
- (b) Calculate the reflective efficiency of this retro-reflector if the reflectance R on the rear semi-sphere interface is 0.96. (5%)

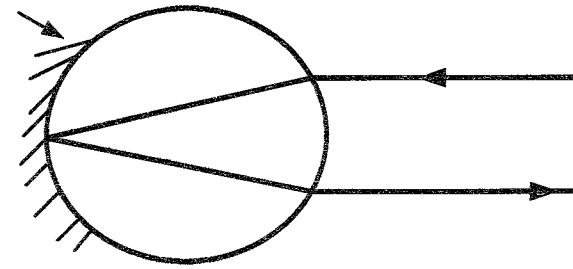


Fig.1

4. (15%) For the Young's slit experiment, if the aperture to screen distance is 1.6 m and the wavelength is 532 nm,
- (a) What slit separation is required to give a fringe spacing of 1.4 mm? (10%)
 - (b) If a glass plate ($n=1.5$) of 0.01 mm thickness is placed over one slit, what is the lateral displacement of the fringe system? (5%)

5. (15%) Figure 2 shows a lens with radius of curvature R lying on a flat glass plate and illuminated from above by light with wavelength λ . Therefore, circular interference fringes (called Newton's rings) appear, associated with the variable d of the air film between the lens and the plate. If the center is the dark fringe, find the radii r of the interference minimum assuming $r/R \ll 1$.

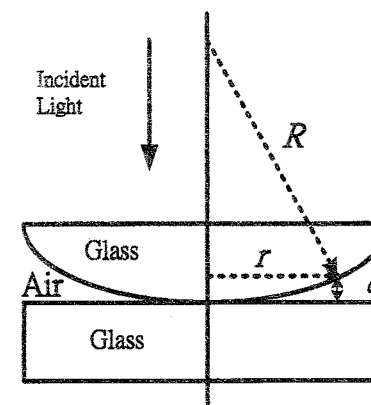


Fig. 2

6. (10%) In a double-slit experiment, the wavelength λ of the light source is 632 nm, the slit separation d is 21 μm , and the slit width a is 3.8 μm . Consider the interference of light from the two slits and also the diffraction of light through each other. How many bright interference fringes are within the central peak of the diffraction envelope?
7. (10%) Given that 150 W/m^2 of randomly polarized light is incident normally on a stack of ideal linear polarizers that are positioned one behind the other with the transmission axis of the first vertical, the second at 30° , the third at 60° , and the fourth at 90° . How much light emerges?