

國立中央大學 109 學年度碩士班考試入學試題

所別： 光電類

共 2 頁 第 1 頁

科目： 光學

本科考試可使用計算器，廠牌、功能不拘

\*請在答案卷(卡)內作答

- (15 pts) Stacking transparent plastic films can make this stack of films looks highly reflective like a mirror. Mathematically derive the transmittance of normally incident light into  $N$ -layers of dielectric film/slab with refractive index of  $n$  and air in between the layers. (Neglect the thickness of the film/slab and the interference effect.)
- (20 pts) On the internet, you can search "Newton two prism" and found a lot of figures like Fig.1. Such figures are trying to explain Newton's observation that white light is the combination of different color light and these light can be combined back to white light for high school students. However, these figures are wrong. Please identify the error. And draw a correct figure that allow Newton to perform the experiment. (Hint: Newton used two prisms and a lens.)

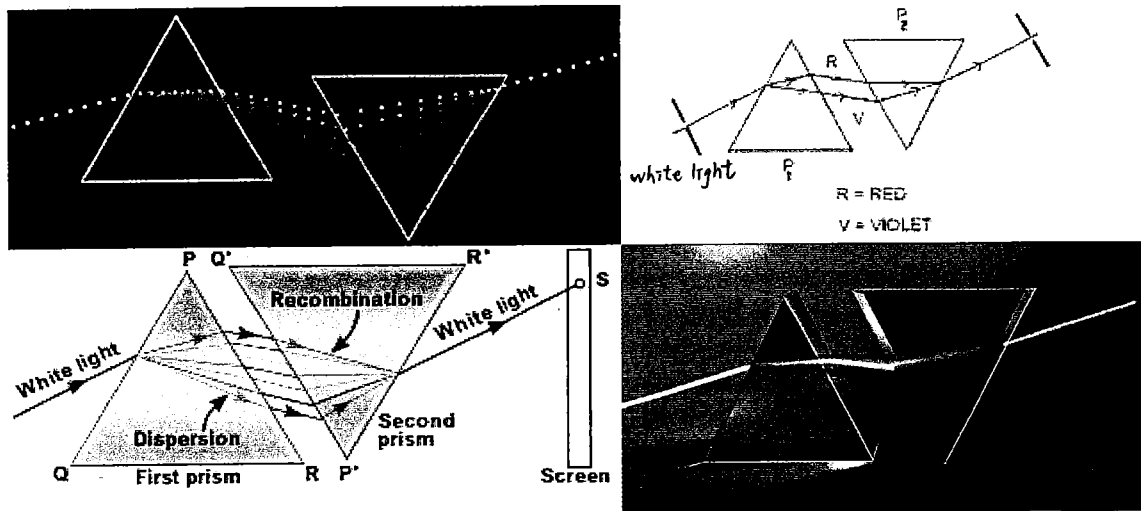


Fig. 1. Figures found on the internet. A pair of identical prisms split white light into its spectrum and recombine the spectrum back to white light.

- (15 pts) An optical system consists 3 thin lens, L1, L2 and L3 with focal lengths  $f_1=50$  mm,  $f_2=-100$  mm and  $f_3=50$  mm. The lenses are arranged in the order L1, L2 and L3. The distance between L1 and L2 is 10 mm and the distance between L2 and L3 is 20 mm as shown in Fig.2. Do the ray-tracing and find the focal point, focal length and the corresponding principle plane of the system if the light is coming from the left.

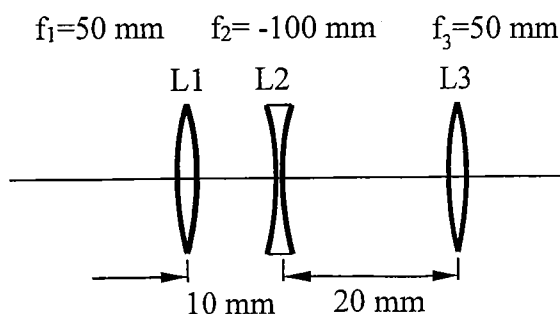


Fig. 2. Three lens system

參考用

注意：背面有試題

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4. In the Youngs double slits interference experiment, a single monochromatic light source with wavelength of 500nm is used, two slits splitting the light into two infinitely small pinhole spherical waves. The spacing between the two slits is 10um. The interferogram is formed on the distance wall 1 meter away from the slit plane as shown in the following Figure 3. Make all assumption you need for following questions. (25pts, 5pts each)

- What is the interference fringe spacing distance on the observation wall?
- If one of the slit is blocked , how will the interference pattern change?
- If one of the slit doubled its width , how will the interference pattern change?
- If a thin glass plate with thickness  $d = 2\mu\text{m}$  with refractive index  $n = 1.3$  is inserted into one of the slit opening, how will the interference pattern change?
- If each slit use its own independent laser light sources, and the wavelengths of the two laser light sources are 500nm and 520nm respectively. Describe the changed interference pattern.

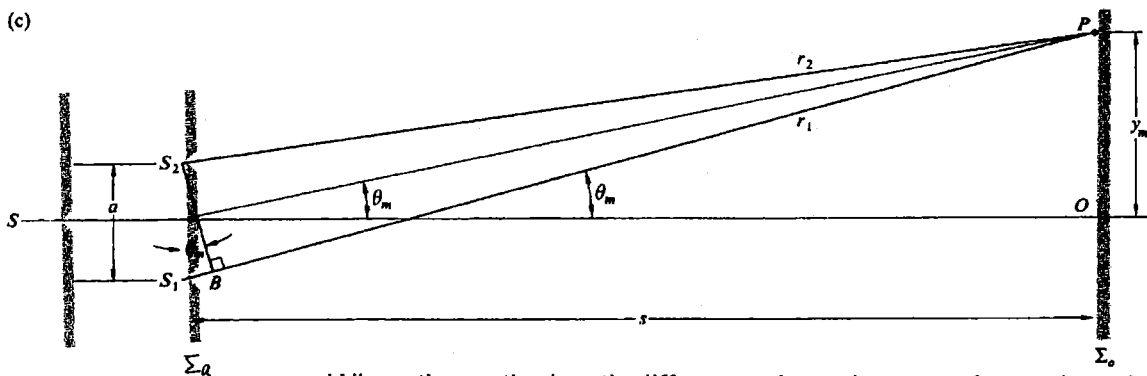


Fig. 3. Young's double slit experiment

- In the Newton ring interference fringe observation, a slight convex lens with radius of curvature of 5m is place against an optical flat surface , the lens diameter is 10mm. (25pts, 5pts each)
  - Explain why the contacting point (center of lens ) always has dark fringe.
  - How many concentric fringes is observed ?
  - If the two glass is placed in the water with refractive index of 1.33, how will the fringe pattern change?
  - Hand press on the right side of the glass, how will the fringe change when pressing?
  - Is high coherent light source required to see the Newton Ring interference? Explain for credit.

參考用

注意:背面有試題