國立中央大學103學年度碩士班考試入學試題卷

所別：光電科學與工程學系碩士班 不分組(一般生)　科目：光學　共 2 頁　第 1 頁

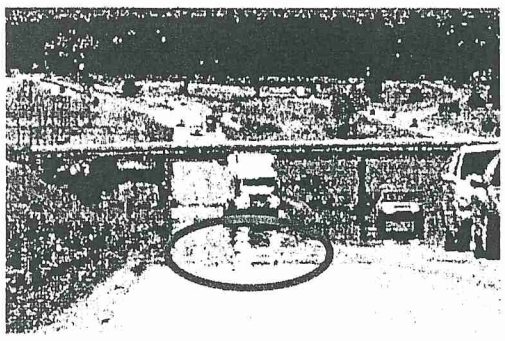
本科考試可使用計算器，廠牌、功能不拘　　＊請在試卷答案卷（卡）內作答

1. List the five major types of monochromatic aberrations. (5%)

2. Describe the reason why the color of the sky in a sunny day, on the earth, is blue. What do you think the color of the "moon sky" is in its "sunny day"? Why do you think so? (7%)

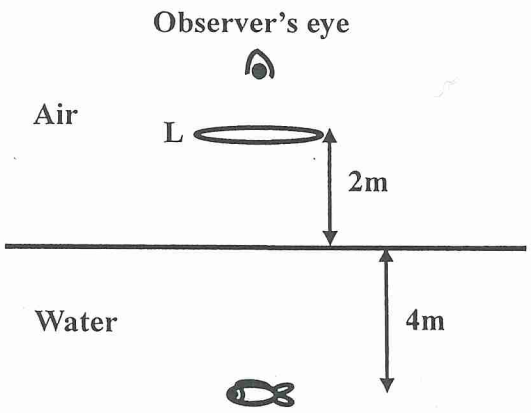
3. Propagation of a "circular wave" on a flat surface is somewhat different from propagation of a "spherical wave" in space. Suppose there is a source point at (X, Y), what is the mathematical expression for the "circular wave" it produces at the location (x, y)? We note that a source basically produces an amplitude function $A\cos(\omega t)$. In short, you will find an expression for the wave amplitude like $B\cos(Ck-Dt)$, where k is the propagation number $2\pi/\lambda$. This problem is to find B, C, and D in the above expression. (8%)

4. In a very hot sunny day afternoon, there appear something like a "water pond" in front of the car on the highway (see the figure below in the elliptical circle). Please give the reason why we can observe this phenomenon. (8%)



5. A soap film surrounded by air has an index of refraction of 1.34. If a region of the film appears bright red (λ =630nm) in normally reflected light, what is its minimum thickness there? (8%)

6. A small fish is at 4 meters below a flat water surface. An observer is looking at this fish through a lens of small diameter. Suppose this convex lens is of focal length 15 meters and is at a distance 2 meters above the water surface. Where will the image of this fish appear? (12%)



7. Suppose we have three "linear polarizers", A1, A2, and A3, which are parallel to the x-y plane and are stacked together. Each of the polarizer allows light of certain polarization state to pass through. The incident light (plane wave) is in the z-direction, of intensity I_0, and is unpolarized. We let the light going normally through the polarizers sequentially, i.e., first through A1, then A2, and finally through A3. For the following two cases, find the intensity of the transmitted light.

   (a) The "passing directions" for the polarizers are: A1 in the x-direction, A2 in the $\frac{1}{2}\hat{x}+\frac{\sqrt{3}}{2}\hat{y}$ direction, A3 in the y-direction. (5%)

(b) The "passing directions" for the polarizers are: A1 in the $\frac{1}{\sqrt{2}}\hat{x}-\frac{1}{\sqrt{2}}\hat{y}$ direction, A2 in the $\frac{1}{\sqrt{2}}\hat{x}+\frac{1}{\sqrt{2}}\hat{y}$ direction, A3 in the y-direction. (5%)

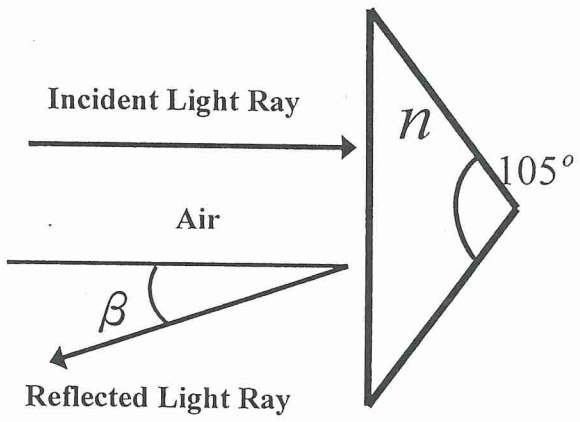
8. Consider a linearly polarized (polarized in the y-direction) plane wave which is propagated in the z-direction. We let this wave propagate through a "half-wave plate". Suppose the fast axis of this half-wave plate makes an angle 30 degree with the y-axis, i.e., 60 degree with the x-axis, what will be the polarization state (or direction) of the transmitted light? (10%)

9. Roughly sketch (or plot) the Fraunhofer diffraction pattern of the following two screens: (10%)

(a)

(b)

10. The following figure shows a prism (index of refraction n=1.5) of apex angle 105 degree. Suppose the incident light ray is horizontal and is normally incident on the prism surface. After bouncing back two times from the prism surfaces, it leaves the prism at an angle β with respect to the horizontal. Find the angle β! (10%)



11. The familiar lens imaging formula may be written as $\frac{1}{p}+\frac{1}{q}=\frac{1}{F}$, where p denotes the object distance, q denotes the image distance, and F is the focal length of the lens. The lateral magnification ratio is $M_x = M_y = \frac{q}{p}$. Find the longitudinal magnification ratio M_z as a function of the lateral magnification ratio M_x or M_y. (12%)

注意：背面有試題