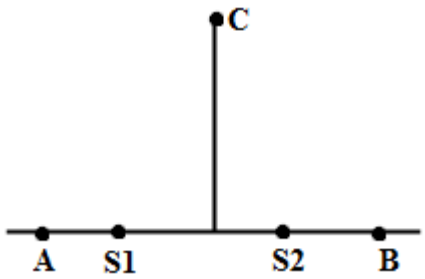
WAVE OPTICS: DEPT OF PHYSICS

MM MARK: 20] **[TIME: 45 MINUTES**

General Instructions:

- ***Question no. 1 to 4 consist of one marks questions, which are very short answer type questions.***
- ***Question no. 5 to 7consist of two marks questions, which are short answer type questions.***
- ***Question no. 8 to 9 consists of three marks questions, which are long answer type questions.***
- ***Question no. 10 consists of four marks question, which are very long answer type question.***
- ***All the questions are compulsory***

1. As shown in the figure, two light waves of the same frequency start from the sources S_1 and S_2 in the same phase. The distance between $S_1S_2 = \lambda/2$. What will be the nature of interference at the points A, B and C.?



2. What changes in the interference pattern in young's double slit experiment will be observed:

(a) Light of a greater frequency is used.

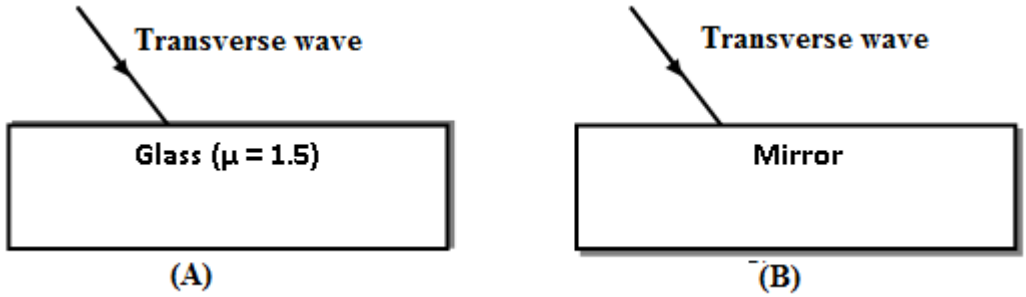
(b) The apparatus is immersed in carbon disulphide ($\mu = 1.6$).

3. How does the resolving power of the telescope change if:

(a) The size of the aperture is decreased.

(b) Focal length of the objective lens is increased.

4. What will be the angle of phase change when a wave travels in two different medium A and B.?



5. In a young's double slit experiment, two slits are separated by 3mm distance and illuminated by light of wavelength 480nm. The screen is 2m from the plane of the slits. Calculate the separation between 8^{th} bright fridge and the 3^{rd} dark fridge observed with respect to the central bright fridge.

OR

A parallel beam of light of wavelength 600nm is incident normally on a slit of width ***d***. If the distance between slits and the screen is 0.8m and the distance of 2^{nd} order minimum from the centre of the screen is 9.5mm, calculate the width of the slit.

6. Answer the following:

(a) What is the backward wavefront not possible during the construction of propagation of wavefronts in a medium using Huygens's principle?

(b) Draw the shape of the wavefront when light emerges out of the convex lens when a point source is placed at the focus. Give reason.

7. Give reasons:

(a) No interference pattern is detected when two coherent sources are infinitely close to one another.

(b) Interference fridges cannot be produced by using two identical bulbs.

(c) Show that when a ray of light is incident on a surface of a transparent medium at the polarizing angle, the reflected and the transmitted rays are plane polarized and are perpendicular to each other.

8. Answer the following:

(a) Calculate the distance that a beam of light of wavelength 500nm can travel without significant broadening, if the diffracting aperture is 3mm wide.

(b) A ray of light is incident on the surface of a glass plate of refractive index 1.53 at the polarizing angle. Calculate the angle of refraction.

(c) Two independent sources cannot be coherent. Explain.

OR

(a) In young's double slit experiment, the intensity of light at a point on the screen where the path difference is λ is k units. Find the intensity at a point where the path difference is:

(i) $\lambda/4$

(ii) $\lambda/3$

(b) Two light waves superimposing at the midpoint of the screen from coherent sources of light of phase difference 3π radian. Their amplitudes are 1 cm each. What will be the resultant amplitude of the given point?

9. Answer the following:

(a) State the essential condition for diffraction?

(b) Why longitudinal waves cannot be polarized?

(c) In a young's double slit experiment , what will be the phase difference between the light waves reaching:

(i) Third dark fridge from the central fridge.

(ii) Third bright fridge. Take $\lambda = 5000A^{o}$.

10. In a young's double slit experiment:

(a) Deduce the conditions for constructive and destructive interference and hence derive the expression for the distance between two consecutive bright or dark fridges.

(b) What change in the interference pattern do you observe if the two slits S_1 and S_2 are taken as point sources?

(c) Plot the graph of the intensity distribution v/s path difference in this experiment. Compare this with the intensity distribution of fridges due to diffraction at a single slit. What important difference do you observe?