e-Resources for Effective Teaching of Interference of Light Dr. Ranjana Abhang abhang95@yahoo.co.in

Interference of Light is a significant phenomenon in physics. A large number of e-resources related to it are available on the internet. Some of them are cited as follows

A powerpoint presentation
giving the summary of Interference is on the website of University of Aberdeen, UK [1]. It contains 30 slides briefing on topics-Interference fringes, Constructive and Destructive Interference-Mathematical conditions, Fringe visibility, Young's double slit interference, its explanation with phasors, comparison of interference due to 2 and 50 slits, Thin film fringes, Haidinger and Fizeau's fringes, Michelson Interferometer, Lloyd's Mirror etc.

A powerpoint presentation "Two source interference" is given by Sylvia (2005) on site

of World of teaching [2]. Constructive and Destructive Interference and the conditions for their occurrence in terms of path difference are explained with diagrams on 6 slides.

In addition, in many powerpoint presentations, videos etc. related to the "Waves", "Wave nature of light", some slides referring to the phenomenon of Interference are present.

Lecture demonstrations
on different subtopics of interference are given by University of California Berkeley [3]. Sketches of experimental set-ups, apparatus with labeled components, resultant patterns etc. are drawn giving explanations. They include interference due to double slit by visible light, microwaves and laser beam (through cornell slit-film); Lloyd's mirror, Michelson Interferometer fringes, Interference in Oil film on water and in Soap film, Ripple Tank with plane and spherical water waves, Newton's rings by transmission and reflection etc.

An interference pattern with bands of constructive and destructive interference created by two sources is shown explaining the concept of path length difference on the site of Boston University, USA [4]. Applet at site of PhysicsLab [5] has similar nature.

Similar interference pattern is presented at University of California, Los Angeles (UCLA) USA site [6] by Wolfgang Christian. Its special feature is that it produces interference patterns using

more than two sources also for varying wavelengths of light sources.

A simple interactive Java applet for two slit interference is given by Michigan State University, USA [7]. The graph of intensity versus distance along the screen is plotted for different values of slit separation and wavelengths of light source.

An
Animation
on Young's Interference experiment (using Adobe Shockwave player) is created by Fast Track at Victoria Junior College (VJC) of Singapore [8].Wavefronts from two secondary sources (slits) derived from a single primary source produce interference bands on a plane screen. The intensity at each point of the resultant wavefront is plotted alongside the bands. Effect on the interference bands and the intensity is observed by varying parameters e. g. Screen distance (2-5 meters), Wavelength of light source (380-750 nm), diameters of slits (0-0.1 mm) and their separation (0.5-1.5 mm).

A similar animation (flashlet) is presented by University of Virginia, USA [9]. Two waves (created by dragging point sources of visible light or the detector at the plate) and the algebraic sum of their amplitudes (i.e. resultant) are shown with two point sources. By pressing "play" a trail of light spots (representing the two-slit interference pattern build up by adding two waves sequentially) is created at the plate. Step size is adjusted with "trail step" slider. The intensity of the resultant of waves is represented by the brightness of light spots. Values of wavelength, amplitude, source to plate distance and the distance between sources are recorded and can be changed by a slider. Path difference vector corresponding to each location of the light spots is shown and its value is noted.

An animation [10] by Walter Fendt (2003) has a distinguishing feature that the screen is semi-circular instead of being plane. The interference patterns of different orders obtained by changing the wavelength of source or the spacing between the slits
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are shown on the screen and also on a linear angle scale (-90
0
to +90
0
). The values of angles for maxima and minima corresponding to different orders are recorded in two boxes. The locations of the current angle are shown by arrows when angle is varied in the range 0
0
-90
0
. Alternatively, the points of minima are shown by red dots in the intensity profile at the bottom. Value of the relative intensity in the interference patterns corresponding to each angle position

is also recorded. Equations giving conditions for maxima and minima of different orders are stated.

An interactive simulation using Java on the website ofUniversity of Coloradoat Boulder [11] is useful to learn the abstract properties of light by analogy with water or sound waves. First wavefronts using one and two sources in the form of drip/s of water, loud speaker/s or source/s of light are created. Their secondary sources are created by inserting slit/s. By using two sources of waves or inserting two slits, interference patterns are obtained. The patterns change as the amplitude and frequency of the sources and the width, location and separation of the slits are varied. Screen chart shows a graph of intensity versus position. By adding a detector, graphs of water level, sound pressure or electric field, versus Time are plotted. By pressing “Show graph”, plots of these quantities versus position are seen. The simulation emphasizes the characteristics that are common to all types of waves.

With such e-resources, students experience that “Physics is Fun and not a subject to shun”

References

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http://www.abdn.ac.uk/physics/px2009/intsum.pdf

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http://buphy.bu.edu/~duffy/semester1/c21_int_2D.html

[5]
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[7]
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[11]
http://phet.colorado.edu/simulations/sims.php?sim=Wave_Interference