EngineeringRise

Wave optics: interference and diffraction

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Speed and wavelength in a medium	v = c/n; lambda_medium = lambda/n Valid when: light entering a medium of index n; frequency stays same	m/s (m)
Snell law from Huygens	sin i/sin r = v1/v2 = n2/n1 Valid when: wavefront refraction at plane boundary, Huygens construction	dimensionless
Resultant intensity	I = I1 + I2 + 2 square root of (I1 I2) cos(phi) Valid when: two coherent sources of same frequency; phi is phase difference	W/m^2
Phase and path difference	phi = (2 pi/lambda) x path difference Valid when: any two waves of wavelength lambda in the same medium	radian
Intensity ratio	Imax/Imin = ((a1 + a2)/(a1 - a2))^2 Valid when: two coherent sources with amplitudes a1 and a2	dimensionless
Young: bright fringes	y_n = n lambda D/d Valid when: Young double slit, small angles, D much larger than d; n = 0, 1, 2...	m
Young: dark fringes	y = (n - 1/2) lambda D/d Valid when: Young double slit, small angles, D much larger than d; n = 1, 2, 3...	m
Fringe width	beta = lambda D/d Valid when: Young double slit, small angles; fringes equally spaced	m
Shift due to a thin sheet	Delta y = (n - 1) t D/d Valid when: thin sheet over one slit; central fringe shifts toward the sheet	m
Single-slit minima	a sin(theta) = n lambda Valid when: single slit width a; minima only, n = 1, 2, 3...; small angles	m
Width of the central maximum	2 lambda D/a Valid when: single slit; distance between first minima on screen, small angles	m

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/optics/wave-optics-interference-and-diffraction

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