Wave Optics

- **Huygen's Principal of Secondary waves** $i = r$

  i = incident angle
  r = reflected angle
  n_{21} = refractive index

- $\frac{\sin i}{\sin r} = \frac{v_1}{v_2} = \text{constant}$ $\quad n_{21} = \frac{v_1}{v_2} = \frac{\text{velocity of light in first medium}}{\text{velocity of light in second medium}}$

- $v = \frac{c}{n}$ $\quad n$ = refractive index, c = velocity of light $\quad \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = n_{21}$

- **Optical Path** $c \times t = nd$ $\quad d$ = distance

- **Doppler Effect** $\frac{\Delta \nu}{\nu} = -\frac{v_{radical}}{c}$ (change in frequency; velocity)

- **Refractive index of water relative to air** $n = \frac{\lambda}{\lambda_w}$ OR $\lambda_w = \frac{\lambda}{n}$

- **Interference** $I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

- **Positions of Bright fringes** $x = n\frac{D\lambda}{d}$

- **Fringe Width** $\beta = \frac{D\lambda}{d}$

- **Positions of Dark fringes** $x = \left[n - \frac{1}{2}\right]\frac{D\lambda}{d}$

- **Angular Fringe - Width** OR **Angular Path difference** $\theta = \frac{\lambda}{d}$

- **Displacement of fringe** $x_0 = \frac{D}{d}(n-1)t$

- **thickness of plate** $t = \frac{x_0 \lambda}{W(n-1)}$

- **Diffraction of light due to a single slit** $e\sin\theta = \pm m\lambda$ $\quad e\sin\theta = (2m+1)\frac{\lambda}{2}$

- **Angular width of Central maximum** $2\theta = \frac{2\lambda}{e}$

- **Linear width of Central maximum** $2x = \frac{2\lambda}{e} \times f$

- **Resolving power of Telescope** $1.22\frac{\lambda}{d}$

- **Fresnel distance** $Z_F = \frac{r^2}{\lambda}$

- **Resolving power of microscope** $\frac{1.22\lambda}{2n\sin\alpha}$

- **Brewster's law** $u = \tan i_B$

- **Coherent and non - coherent addition of waves**

1. $I \propto a^2$ $\quad I$ = Intensity, a = amplitude

2. **Coherent Waves** : No phase difference

   displacement $y = 2a\cos\omega t$

   Amplitude $2a$

   Intensity $I = 4I_0$ where $I_0 \propto a^2$