Module 1 Unit 1

PRINCIPLES OF LASERS - FORMULAS

(As per Revised Curriculum SVU R-2023)

Parameter	Formula
1. Energy of radiation; Wavelength of laser emitted	$E = \frac{hc}{\lambda}$ $\lambda = \frac{hc}{E_2 - E_1}$
2. Number of photons emitted/sec; Number of photons emitted	$n_t = \frac{P_{optical} \times \lambda}{hc}$ $n = n_t \times \Delta t$
3. Beam Intensity	$I = \frac{P}{A}$
4. Efficiency of laser (electrical pumping/direct conversion)	$\eta = \frac{P_{optical}}{V_{operating} \times I_{operating}}$
5. Coherence length	$l_{coh} = \frac{\lambda^2}{\Delta\lambda}$
6. Divergence	$\Phi = \frac{d_1 - d_2}{Z_1 - Z_2}$
7. Ratio of population of two energy levels	$\frac{N_1}{N_2} = e^{(E_2 - E_1)/kT}$
8. Ratio of rates of spontaneous to stimulated emission	$R = e^{h\upsilon/kT} - 1$
9. Ratio of Einstein's A and B coefficients	$\frac{A_{21}}{B_{21}} = \frac{8\pi h\nu^3}{c^3}$
10. Threshold condition for lasing	$\gamma = \alpha_C + \frac{1}{2L} \ln \frac{1}{R_1 R_2}$

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