Module 1 Unit 3

PRINCIPLES OF LASERS – FORMULA SHEET

Parameter	Formula
1. Ratio of population of two energy levels	$\frac{N_1}{N_2} = e^{(E_2-E_1)/kT}$
2. Ratio of rates of spontaneous to stimulated emission (also called Einstein's A/B ratio)	$\frac{A_{21}}{B_{21}} = \frac{8\pi h\nu^3}{c^3}$
3. Wavelength of laser emitted	$\lambda = \frac{hc}{E_2 - E_1}$
4. Number of photons emitted per second (or number of photons emitted)	$n' = \frac{P_{optical} \times \lambda}{hc}$ $n = n' \times \Delta t = \frac{P_{optical} \times \lambda \times \Delta t}{hc}$
5. Efficiency of laser (electrical pumping/direct conversion)	$\eta = \frac{P_{optical}}{V_{operating} \times I_{operating}}$
