Module 2 Unit 3

OPTICAL FIBRES – FORMULA SHEET

Parameter	Formula
1. Numerical Aperture	$NA = n_0 \sin(\theta_c)$ $NA = \sqrt{n_1^2 - n_2^2}$ $NA = n_1\sqrt{2\Delta}$
2. (External) Acceptance angle	$\theta_c = \sin^{-1}(NA)$
3. (Internal) Critical angle	$i_0 = \sin^{-1}\left(\frac{n_2}{n_1}\right)$ $i_0 = \sin^{-1}(1-\Delta)$
4. Fractional refractive index	$\Delta = \frac{n_1 - n_2}{n_1}$ $n_2 = n_1(1-\Delta)$
5. V-number/ Normalized frequency	$V = \frac{2\pi a}{\lambda} NA$ $V < 2.405$ for SM fibre
6. Number of modes	$N_m = \frac{V^2}{2}$ for SI fibre $N_m = \frac{V^2}{4}$ for GRIN fibre
7. Attenuation coefficient	$\alpha = \frac{1}{L} 10 \log\left(\frac{P_{in}}{P_{out}}\right)$ dB/km (L taken in km)
8. Intermodal dispersion	$\tau_i = \frac{n_1 L \Delta}{c}$ sec for SI fibre $\tau_i = \frac{n_2 L \Delta^2}{2c}$ sec for GRIN fibre (parabolic profile only) 1 sec/m $\equiv 10^{12}$ ns/km
9. Max. bit rate	$B = \frac{0.7}{\tau}$ bits/sec; $\tau = \sqrt{\tau_i^2 + \tau_m^2}$
