

Lista III

13/04/2022

Disciplina: Comunicações Ópticas

Professora: Dra. Cindy Stella

Aluno: Lugo Costa das Flores

01)

Núcleo: $50\mu\text{m}$

$$n_1 = 1,5$$

casca: $125\mu\text{m}$

$$n_2 = 1,48$$

$$\theta_a = \sin^{-1}(0,2441)$$

$$\theta_a = 14,1286^\circ$$

$$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$

$$\theta_c = \sin^{-1}\left(\frac{1,48}{1,5}\right)$$

$$AN = n_1 \sin \theta_a = \sqrt{n_1^2 - n_2^2}$$

$$AN = \sqrt{2,25 - 2,1904}$$

$$AN = \sqrt{0,0596}$$

$$AN = 0,2441$$

$$\theta_B = \arctan\left(\frac{n_2}{n_1}\right)$$

$$\theta_B = \tan^{-1}(0,986)$$

$$\theta_B = 44,596^\circ$$

$$\theta_c = \sin^{-1}(0,986)$$

$$\theta_c = 80,401^\circ$$

02)

$$n_1 = 1,48$$

$$n_2 = 1$$

$$n = 1$$

$$AN = \sqrt{n_1^2 - n_2^2}$$

$$AN = \sqrt{2,1904 - 1}$$

$$AN = \sqrt{1,1904}$$

$$AN = 1,0910$$

$$\theta_c = \sin^{-1}\left(\frac{1}{1,48}\right)$$

$$\theta_c = \sin^{-1}(0,6756)$$

$$\theta_c = 42,5007^\circ$$

03)

$$n_1 = 1,475$$

$$n_2 = 1,460$$

$$a = 25 \mu\text{m}$$

a)

$$\theta_c = \arcsin\left(\frac{n_2}{n_1}\right)$$

$$\theta_c = \arcsin\left(\frac{1,460}{1,475}\right)$$

$$\theta_c = \arcsin(0,9898)$$

$$\theta_c = 81,8095^\circ$$

b)

$$\theta_a = \arcsin\left(\frac{AN}{1}\right)$$

$$\theta_a = \arcsin(0,2097)$$

$$\theta_a = 12,1047^\circ$$

c)

$$AN = \sqrt{1,475^2 - 1,460^2}$$

$$AN = \sqrt{2,1756 - 2,1316}$$

$$AN = \sqrt{0,044}$$

$$AN = 0,2097$$

04)

$$n_1 = 1,48$$

$$n_2 = 1,47$$

$$dn = 80 \mu\text{m}$$

$$\lambda = 850 \text{ nm}$$

$$V = \frac{\pi \cdot d}{\lambda} AN$$

$$V = \frac{\pi \cdot 80}{0,85} \cdot 0,1717$$

$$V = \frac{251,327}{0,85} \cdot 0,1717$$

$$V = \frac{43,152}{0,85}$$

$$V = 50,767$$

$$AN = \sqrt{1,48^2 - 1,47^2}$$

$$AN = \sqrt{2,1904 - 2,1609}$$

$$AN = \sqrt{0,0295}$$

$$AN = 0,1717$$

Lista III

13/04/2022

05)

$$n_1 = 1,5$$

$$n_2 = 1,46$$

$$\lambda = 1310 \text{ nm}$$

$$d = 150 \text{ nm}$$

$$V = \frac{\pi d}{\lambda} \cdot AN$$

$$V = \frac{150\pi \cdot 0,3440}{1,310}$$

$$V = \frac{162,106}{1,310}$$

$$V = 123,745$$

$$AN = \sqrt{1,5^2 - 1,46^2}$$

$$AN = \sqrt{2,25 - 2,1316}$$

$$AN = \sqrt{0,1184}$$

$$AN = 0,3440$$

06)

$$d = 100 \mu\text{m}$$

$$AN = 0,158$$

$$\lambda = 900 \text{ nm}$$

$$V = \frac{100\pi}{0,9} \cdot 0,158$$

$$V = 55,1524$$

$$M = \frac{V^2}{2}$$

$$M = \frac{55,1524^2}{2}$$

$$M \approx 1520,8938 \text{ modos}$$

07)

a) $V = \dots$

$$d = 80 \mu\text{m}$$

$$\Delta = 1,5\% = 0,015$$

$$\lambda = 850 \text{ nm}$$

$$AN = n_1(2\Delta)^{1/2}$$

↑
Falta o valor de n_1

08)

$$d = 50 \mu\text{m}$$

$$AN = 0,2$$

$$\lambda = 1 \mu\text{m}$$

$$V = \frac{50\pi}{1} \cdot 0,2$$

$$\underline{V = 10}$$

$$M_G = \frac{10^2}{4}$$

$$M_G = \frac{100}{4}$$

$$\underline{M_G = 25}$$

09)

$$n_i = 1,5$$

$$\Delta = 1\% = 0,01$$

$$\lambda = 1,31 \mu\text{m}$$

$$\alpha = 2$$

$$V_m = 2,4 \left(1 + \frac{2}{\alpha} \right)^{\frac{1}{2}}$$

$$V_m = 2,4 \cdot 1,4142$$

$$\underline{V_m = 3,3940}$$

$$AN = n_i (2\Delta)^{\frac{1}{2}}$$

$$AN = 1,5 (0,02)^{\frac{1}{2}}$$

$$\underline{AN = 0,2121}$$

$$V = \frac{\pi d}{\lambda} AN \rightarrow \frac{V \lambda}{\pi AN} = d$$

$$d = \frac{3,3940 \cdot 1,31}{0,2121 \pi}$$

$$\underline{d = \frac{4,4461}{0,6663} = 6,67 \mu\text{m}}$$

10)

$$n_i = 1,46$$

$$d = 9 \mu\text{m}$$

$$\Delta = 0,0025$$

$$V_m = \frac{9\pi \cdot 0,0073}{\lambda}$$

$$\lambda = \frac{9\pi \cdot 0,0073}{3,3940}$$

$$\lambda = \frac{0,2064}{3,3940}$$

$$\lambda = 0,0608 \mu\text{m}$$

$$\text{ou } \lambda = 60,8 \text{ nm}$$

$$AN = 1,46 \cdot (2 \cdot 0,0025)^{\frac{1}{2}}$$

$$\underline{AN = 0,0073}$$

Usando V_m da outra questão