$i_0 = \sin^{-1}\left(\frac{n_2}{n_1}\right) = \sin^{-1}\left(\frac{1.48}{1.5}\right)$

 $\theta_{c} = \sin^{-1}(\sqrt{n_{1}^{2}-n_{2}^{2}}) = \sin^{-1}(\sqrt{15^{2}-148^{2}})$

Data:
$$n_1 = 1.5$$
, $n_2 = 1.48$
to find: i_0 , θ_c

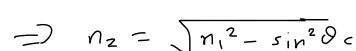
= $80\cdot63^{\circ}$

= 14.17°

2 Data:
$$O_c = 25^{\circ}$$
, $n_1 = 1.52$
to find: n_2
 $NA = Sin O_c = \sqrt{n_1^2 - n_2^2}$

= $\int |\cdot 52^2 - \sin^2(25)$

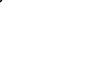
= 1.46



3 Data:
$$\Delta = 0.0025$$
, $\eta_1 = 1.45$
to find: NA, θ_c

$$NA = N_1 \int 24$$

$$= 1.45 \int 2 \times 0.0025$$



@ Data:
$$\theta_c = 25^\circ$$
, $i_0 = 70^\circ$
to find: n_1, n_2

$$\sin i_1 - \frac{n_2}{2} = \sin \theta_c = \sqrt{n_1^2}$$

$$\sin i_0 = \frac{n_2}{n_1}$$
, $\sin \theta_c = \int n_1^2 - n_2^2 = \int \int n_1^2 - n_1^2 \sin^2 i_0$

 $n_{-} = n_{1} \sin i_{0} = 1.23 \times \sin (70) = 1.16$

$$= \frac{\sin \theta_0}{\int_{1-\sin^2 i_0}} = \frac{\sin (25)}{\int_{1-\sin^2 i_0}} = 1.23$$

5 Dola:
$$n_1 = 1.46$$
, $n_2 = 1.42$, $\lambda = 1.3 \, \mu m$, $\alpha = 0.05 \, mm$
to find V , λm (sI fibre)
$$V = \frac{2\pi \alpha}{\lambda} NA = \frac{2\pi \alpha}{\lambda} \times \sqrt{n_1^2 - n_2^2}$$

 $= \frac{2 \times 3.14 \times 0.05 \times 10^{-3}}{1.3 \times 10^{-6}} \times \sqrt{1.46^2 - 1.42^2}$ = 81.98

= 81.98 $= \frac{\sqrt{2}}{2} (SI fibre) = \frac{81.98^2}{2} = 3360 \text{ mode}$

to find: Nm for
$$\lambda_1$$
 and λ_2 (Graded index fibre)

 $N_2 = n_1 \sin i \sigma = 1.48 \times \sin (80^\circ) = 1.46$
 $V = \frac{2\pi \alpha}{\lambda} \times \int_{n_1^2 - n_2^2} = \frac{2 \times 3.14 \times 0.15 \times 10^{-3}}{1550 \times 10^{-9}} \times \int_{1.48^2 - 1.46}^{2} (\lambda_1)$

(>)

€ Dala: α = 0.15 mm, λ,=1550 nm, λ, = 850 nm, (0 = 80°, n, = 1.48

 $1 \times (\lambda_1) = 147.37 = 1 \times (\lambda_1) = \frac{\sqrt{2}}{4} = \frac{1.47.37^2}{4} \approx 5429$ 27, a Jn12-n22 = 2.28 × 10-4 m

$$V(\lambda_2) = \frac{2 \cdot 28 \times 10^{-4}}{850 \times 10^{-9}} = 268 \cdot 23 \Rightarrow N_{23}(\lambda_2) = \frac{\sqrt{2}}{4}$$
$$= \frac{268 \cdot 23^2}{4} = 17987$$

to find; a (for sm operation)

fer SM,
$$V < 2.405$$
 i.e $\frac{2\pi \alpha}{\lambda} \times 14A < 2.405$

i.e. $\alpha < \frac{2.405 \times \lambda}{2\pi \times 14A}$

i.

15 1.3 mm

② Data: λ = 85 σν β. NA = 0.025

B Data:
$$\alpha = 5 \text{ nm}, \lambda = 850 \text{ nm}, n_1 = 1.4, n_2 = 1.399}$$

to check: if it works as SM fibre
$$V = \frac{2\pi\alpha}{3} \times 114 = \frac{2\pi\alpha}{3} \times \sqrt{n_1^2 - n_2^2}$$

to check: if it works as SM Fibre
$$V = \frac{2\pi^{\alpha}}{3} \times 10^{4} = \frac{2\pi^{\alpha}}{3} \times \sqrt{n_{1}^{2} - n_{2}^{\alpha}}$$

$$= \frac{2 \times 3./4 \times 5 \times 10^{-6}}{850 \times 10^{-9}} \times \sqrt{1.4^{2} - 1.399^{2}}$$

= 1.95 < 2.405since V < 2.405, Fibre will work as SM fibre