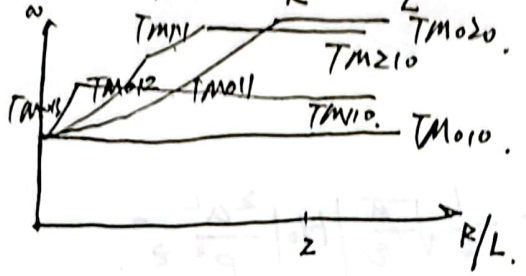
8.6.

(a).

TM: $\psi = E_0 J_m(\gamma_{mn}\rho) e^{\pm im\phi}$, $\gamma_{mn} = \frac{\chi_{mn}}{R}$.

$\omega_{mnp} = \frac{1}{\sqrt{\mu\varepsilon}} \sqrt{\frac{\chi_{mn}^2}{R^2} + \frac{p^2\pi^2}{L^2}}$. $p \geq 0$.

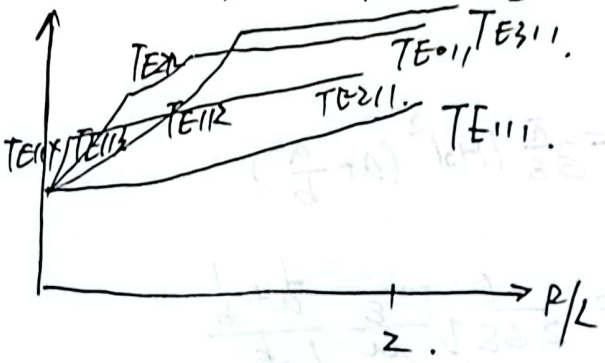



$\frac{R}{L} \to 0$ 时: $TM_{010}, TM_{011}, TM_{012}, TM_{013}$

$\frac{R}{L} \to \infty$ 时: $TM_{010}, TM_{110}, TM_{210}, TM_{020}$.

TE. $\psi = H_0 J_m(\gamma_{mn}\rho) e^{\pm im\phi}$, $\gamma_{mn} = \frac{\chi_{mn}}{R}$.

$\omega_{mnp} = \frac{1}{\sqrt{\mu\varepsilon}} \sqrt{\frac{\chi_{mn}^2}{R^2} + \frac{p^2\pi^2}{L^2}}$ $p \geq 0$.




$\frac{R}{L} \to 0$: $TE_{111}, TE_{112}, TE_{113}, TE_{11p}$

$\frac{R}{L} \to \infty$: $TE_{111}, TE_{211}, TE_{011}, TE_{311}$.

(b). $TM_{010}$.

$f = \frac{\omega}{2\pi} = \frac{1}{\sqrt{\mu\varepsilon}} \frac{\chi_{01}}{2\pi R} \approx 5.7$ GHz.

$Q_{010} = \omega \frac{U}{P} = \frac{\mu}{\mu_0} \frac{L}{\delta} \cdot \frac{1}{1+\frac{L}{R}}$, $\delta = 8.1 \times 10^{-7}$ m.

$\approx 1.4 \times 10^4$.