(7)

$$P = \frac{E^2 R}{(R+r)^2}$$

If E and r are fixed R varies what is the maximum value of power

$$P = \frac{E^2 R}{(R+r)^2}$$

$$\frac{d}{dp} = \frac{d}{dp} E^2 R (R+r)^{-2}$$

$$\frac{d}{dp} = -2E^2 (R+r)^{-3} \cdot 1$$

$$\frac{d}{dP} \frac{d}{dP} = \frac{-2E^2}{(R+r)^3}$$

$$P' = \frac{-2E^2}{(R+r)(R+r)R+r}$$

$$P' = \frac{-2E^2}{R^2+3R^2r+3r^2R+r^3} + \frac{E^2}{(R+r)^2}$$

$$= \frac{E^2(R+r)}{(R+r)^3} + \frac{-2E^2R}{(R+r)^3}$$

$$\frac{E^2r - E^2R}{(R+r)^3}$$

$$\frac{E^2(r-R)}{(R+r)^3}$$

At maximum power

$$R = r$$

$$\frac{dP}{dR} = 0$$

$$\frac{E^2(r-R)}{(R+r)^3} = 0$$

$$E^2(r-R) = 0$$

$$E^2 = 0 \quad \text{or}$$

$$r - R = 0$$

$$r = R$$

And so Critical Point when

$$r = R .$$