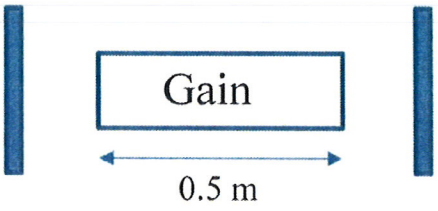
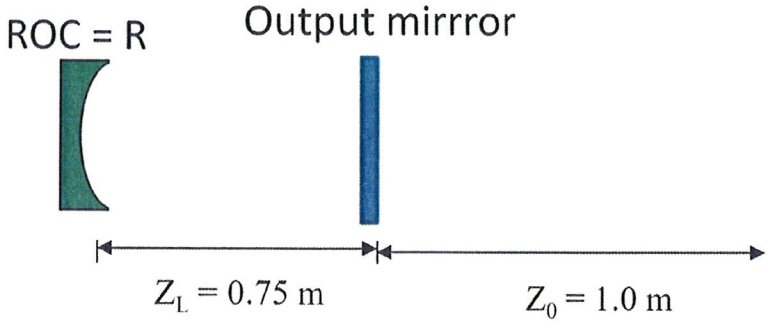
A homogeneously-broadened Fabry-Perot laser with 5 mm diameter flat circular mirrors and a gain cell 0.5 meters long has an unsaturated gain coefficient (at the oscillation frequency) of $g_0(n_0) = 0.24\ m^{-1}$ and a saturation intensity (at the oscillation frequency) of $I_s(n_0) = 70$ watts/cm^2.



a) Assuming the two mirrors are identical, lossless, with 7.5 % (intensity) transmittance, and there is a 2 % power loss per pass due to diffraction and scattering, what is the saturated gain in the laser? (1 pt)
b) What is the intracavity laser intensity (intensity inside the laser)? (1 pt)
c) What is the output power of the laser? (Neglect the shape of the mode and just assume the output mirror is uniformly illuminated). (0.5 pts)
d) Now assume the back mirror of the laser is changed to have a radius of curvature of R, the output mirror is flat, and the separation between mirrors is 3/4 meter. What value of R will produce a Gaussian laser beam with a Rayleigh range $z_0 = 1$ meter? Assume that the index of refraction of the gain medium is 1.0. You can assume an arbitrary wavelength. (1 pt)



e) What is the radius of curvature of the beam 1 meter from the output mirror? (0.5 pts)