NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210 MIDTERM EXAM II 12/98 Prof. Powers

- This exam is open book and notes.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be sure to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.
- Enter your name in the space provided.

1	
2	
3	
Total	

Name: _____

1. Consider a laser with a small-signal round-trip gain of 0.12 and a round-trip internal loss of 0.055. It operates with one mirror partially reflecting and the other mirror totally reflecting. Calculate the ratio of the output power when the output–mirror reflectivity is 96% to the output power when the output mirror has the optimum reflectivity.

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2. Consider a laser resonator with two concave mirrors that have a radius of curvature of +2 m and a mirror spacing of 1 m. The laser operates at 500 nm. Calculate

   (a) the spot size of the beam at a location that is 30 cm to the left of the beam waist *and*

   (b) the radius of curvature of the phase at the same location.

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3. Consider a diode laser with the properties listed in the table below. Calculate the threshold population difference density, $\Delta N_{\mathrm{TH}}/\mathrm{Vol}$, for this laser.

Parameter	Value
α_{int}	10 cm^{-1}
L	500 μm
λ	850 nm
Broadening	Lorentzian
$\Delta\nu$	15 THz
τ_s	9.5 ns
R_1	36%
R_2	36%
n	3.6