

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210

MIDTERM EXAM II

12/99 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 operating at 632.8 nm with the parameters shown below.

Parameter	Value
Unsaturated gain coefficient	0.8 m ⁻¹
Internal loss coefficient	0.01 m ⁻¹
Mirror separation	20 cm
Non-output mirror reflectivity	100%
Beam diameter	6 mm (assumed constant over resonator length)

- (a) Find the optimum reflectivity of the output mirror for this laser.
 (b) Find the ratio of the output power for this laser with an optimized output mirror to the output power of this laser if the internal losses were zero.



2. Consider a laser resonator with two mirrors. One mirror has a radius of curvature, r_1 , of +50 cm and the mirror spacing of 10 cm. The laser operates at 1,060 nm.

- (a) Calculate the range of acceptable *positive* values of the mirror curvature, r_2 , that will ensure a stable resonator.
 (b) Calculate the range of acceptable *negative* values of the mirror curvature, r_2 , that will ensure a stable resonator.



3. Consider a laser with the properties listed in the table below. The lineshape of this laser is given by

$$g(\nu) = (1.879 \times 10^{-11}) \exp [(-1.109 \times 10^{-21}) \nu^2 + (5.12 \times 10^{-7}) \nu - 5.91 \times 10^7] . \quad (1)$$

Parameter	Value
L	10 cm
R_1	100%
R_2	97.5%
n	1.35
λ	1300 nm
A	2 cm ²

Calculate the expected output power from this laser when it is pumped with a pump power that is ten times (10x) the laser's threshold pump power.