NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210 MIDTERM EXAM I 11/91Po

- 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. A laser operating at 1 μm has a normalized spectral power density as shown. (Note: On the x-axis of the figure, 1E9 -1×10^9.) Find the longitudinal coherence length of this laser.

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2. A Michelson interferometer is set up as shown. The source is laser operating at a wavelength of 500 nm. The distance from the beamsplitter to mirror #1 is 5 cm and the distance from the beamsplitter to mirror #2 is 6 cm. A transparent gas cell that is 3 cm long is placed between the beamsplitter and mirror #2. The following experiment is performed:

   (a) The gas cell is filled with air and the position of the fringes on the observation screen is noted.

   (b) The gas cell is filled with a gas and the shift in fringe positions is noted.

   If the fringes move 528.7 fringe periods, what is the index of refraction n_g of the gas.

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3. Consider a propagating wave described by an electric field whose x-component E_{x} and y-component E_{y} meet the following conditions:

   (a) $E_{\mathrm{x\ max}} = E_{\mathrm{y\ max}} = E_0$ and

   (b) $\phi_{\mathrm{x}} - \phi_{\mathrm{y}} = 60^\circ$.

   Sketch a three-dimensional plot, similar to Fig. 3.4 on page 63 of the notes, showing the *approximate* direction and *approximate* length of the electric field vector at $kz = 0$, $\pi/2$, π, $3\pi/2$, and 2π when $t = 0$. (Please be neat in drawing this graph.)