PH522 DL1

Objective: To study some of the characteristics of the output of a diode laser, including its output power as a function of drive current, its wavelength, and the shape of its uncollimated output beam.

Equipment:

1) diode laser, collimating lens, and driver circuit
2) power meter
3) transmission diffraction grating.

Procedure:

1) Familiarize yourself with the diode laser driver and temperature controller. Note the maximum allowable drive current, as indicated in the specifications of the diode laser.

2) Turn on the diode laser and measure the output power as a function of the drive current. Make at least ten measurements at currents spaced between zero and the maximum drive current. Graph the output power vs. the drive current, and extimate the threshold current.

3) Send the collimated output through the transmission grating and estimate the wavelength of the diode laser from the observed deflection of the diffracted beam. Since the transmission grating is unlabeled, you should first use a HeNe laser to determine the line spacing. For normal incidence on the grating, the diffracted beams satisfy:

$$\sin(\theta_m) = m\frac{\lambda}{a}$$

where a is the line spacing of the grating. Describe your measurements carefully in your lab book, and try to obtain a 1% measurement of the diode laser wavelength.

4) Carefully remove the collimating lens, and estimate the full divergence angle of the uncollimated beam in both the vertical and horizontal directions. Do this by estimating the distance between the "edges" of the beam at some known distance from the laser. Report the full divergence angle (in radians) for both dimensions in your lab manual. Afterwards, replace the collimating lens and recollimate the beam.

5) Use the Gaussian beam formula: $\frac{\theta_{full}}{2} \cong \frac{\lambda}{\pi w_0}$ to estimate the size of the emitting area in both the vertical(x) and horizontal(y) directions, w_{0x} *and* w_{0y}.

6) Assuming that the emitting area is approximately: $A = 4w_{0x}w_{0y}$ estimate the intensity of the output beam at the diode in W/cm^2.

7) Determine the output polarization of the diode laser. You may need to hunt around a little to find the proper components.