PHYS 408 2010/11 term 2

Homework problem set #4 problems 1-4
Assigned: 30/01/2011
Written Solution due 04/02/2011 5 PM in Hennings 328
If you collaborated with anyone, please write their name at the top of your HW

Problem 1 (20 marks) (This isn't a typo)

Look at the homework solutions I posted for the previous homework (HW#3 in this case) and pick a problem that you may have gotten wrong. Describe in words what you may have done wrong and what your misconceptions were. And explain what you didn't understand and what techniques you needed to know in order to solve the problem. Explain in words what you have learned from this.

If you feel you solved all of the problems correctly, then pick a problem and try to find and explain three misconceptions that might lead a person to answer wrongly. To be an expert, you must learn to identify the possible conceptual difficulties that a person may have in order to communicate with them effectively

Problem 2 (20 marks)

Do Exercise 2.4-4 from S&T (page 55) by starting from eqn. 2.4-5

Problem 3 (20 marks)

Prove that the total power of a Gaussian Beam is conserved during propagation

Problem 1 (40 Marks)
Suppose you are in charge of designing the laser communications between a satellite orbiting Earth and one orbiting Mars. If the Earth's laser transmitter will be at a wavelength of λ=1550 nm with $2W_o$=40 cm and a power of 10 Watts what is the peak intensity at Mars? Model the laser propagation as a Gaussian Beam. The mechanical engineers in charge of the laser aiming mount have said they can only guarantee that the laser can be pointed in a particular direction (ie Mars) within 50 micro-radians. If your detector on the Mars satellite is 1 cm x 1 cm, what is the power sensitivity required for this detector (in units of Watts)?

Such a system has been developed. See the course web page for a link providing background info if you are interested