Homework Assignment #3
(due midnight Monday, July 6th)

1. For the engine you identified in the previous homework, calculate the following:

   (a) Mean piston speed at maximum torque and at maximum power. Compare this with the typical values discussed in class. If it is outside the typical range, explain why this may still be correct.

   (b) Brake mean effective pressure (bmep) at maximum torque. Compare this with the typical values discussed in class. If it is outside the typical range, explain why this may still be correct.

   (c) Find or assume a reasonable size for the connecting rod in this engine. Plot V(crankangle)/Vmax as a function of crankangle and compare this with a simple sinusoidal variation in cylinder volume.

   (d) Brake specific fuel consumption (bsfc) at maximum power assuming an air/fuel ratio of 15:1 (spark ignition) or 25:1 (compression ignition), a volumetric efficiency of 100%, and a calorific value of 42 MJ/kg for the fuel. If you are studying a turbo, make a reasonable guess at the boost pressure when computing the intake density. Compare your bsfc with the typical values discussed in class.

   (e) Air-standard cycle efficiency calculated from the formulas derived in class and the arbitrary engine efficiency associated with part (d).

2. A twin-cylinder 2-stroke engine has a swept volume of 150 cm^3. The maximum power output is 19 kW at 11,000 rpm. At this condition, the bsfc is .11kg/MJ and the gravimetric air/fuel ratio is 12:1. If ambient test conditions are 10 C, 1.03 bar and the fuel has a calorific value of 44 MJ/kg, calculate the bmep, the arbitrary overall efficiency and the volumetric efficiency.

3. Calculate the following for the IDI diesel engine shown in Figure 15-23.
   (a copy of Chapter 15 from Heywood is on BbLearn)
   - Maximum torque output
   - Engine speed and mean piston speed at maximum torque
   - Power output at maximum torque
   - Fuel consumption (in liters/hr) at maximum torque
   - Arbitrary efficiency at maximum torque

4. Propose an engine design (including specification of engine type, number of cylinders, cylinder geometry, and maximum speed) for a 1 kw (max) portable genset that is intended for recreational use (i.e. a fourth of July car camping trip). Solve this two ways: (1) making appropriate assumptions for variables appearing in the short version of the performance equations we've developed in class and (2) making appropriate assumptions for variables appearing in the long version of the performance equations we've developed in class. Take time to annotate your solution logic as well as reflect on your results.

5. Propose two personally compelling topics for your research paper. For each topic, write one paragraph explaining why you are interested in this topic and what you already know about this topic. Propose three research questions you want to answer about each topic as a result of a prospective class literature review project. Do a preliminary literature/web search to ensure that there are adequate resources on your topic. Give citations for three promising references about each topic.