

HW#5 Internal Combustion Engines

1) One Cylinder of an automotive Engine may have the following parameters:

Bore = Stroke, Connecting Rod Length = 3/2 * Stroke

$V_d = 400 \text{ cc}$

$T_i = 320\text{K}$

$P_i = 1 \text{ atm}$

CR = 9.5

$\phi = .95, \quad \eta_v = .9$

Fuel is C_8H_{18}

$$x_b = 1 - \exp \left[-a \left(\frac{\theta - \theta_o}{\Delta\theta} \right)^{m+1} \right]$$

The above Equation describes the fraction of Fuel Burned as a function of Crank Angle (θ). Using the following data: $\Delta\theta = 34 \text{ deg}$ (Burn Duration), $a = 5, \quad m = 2$

- A) Determine what θ_0 must be to have a peak pressure at 8°atdc .
- B) Plot P vs θ (from -180 to 180 deg) for the motored case (ie. no firing).
- C) Plot P vs θ for the firing case on the same axis.
- D) Plot P versus V for the motored and fired case on the same axis.

You can assume isentropic expansion/compression in the motored case, and IVC and EVO at BDC. Make whatever assumptions are necessary, and state them.

2) What are the major factors affecting combustion stability in an SI engine?

- 1. _____
- 2. _____
- 3. _____
- 4. _____

3) Ignition is difficult in SI engines running very lean. What techniques can be used to improve the ignition stability of lean-burn engines?

- 1. _____
- 2. _____
- 3. _____
- 4. _____