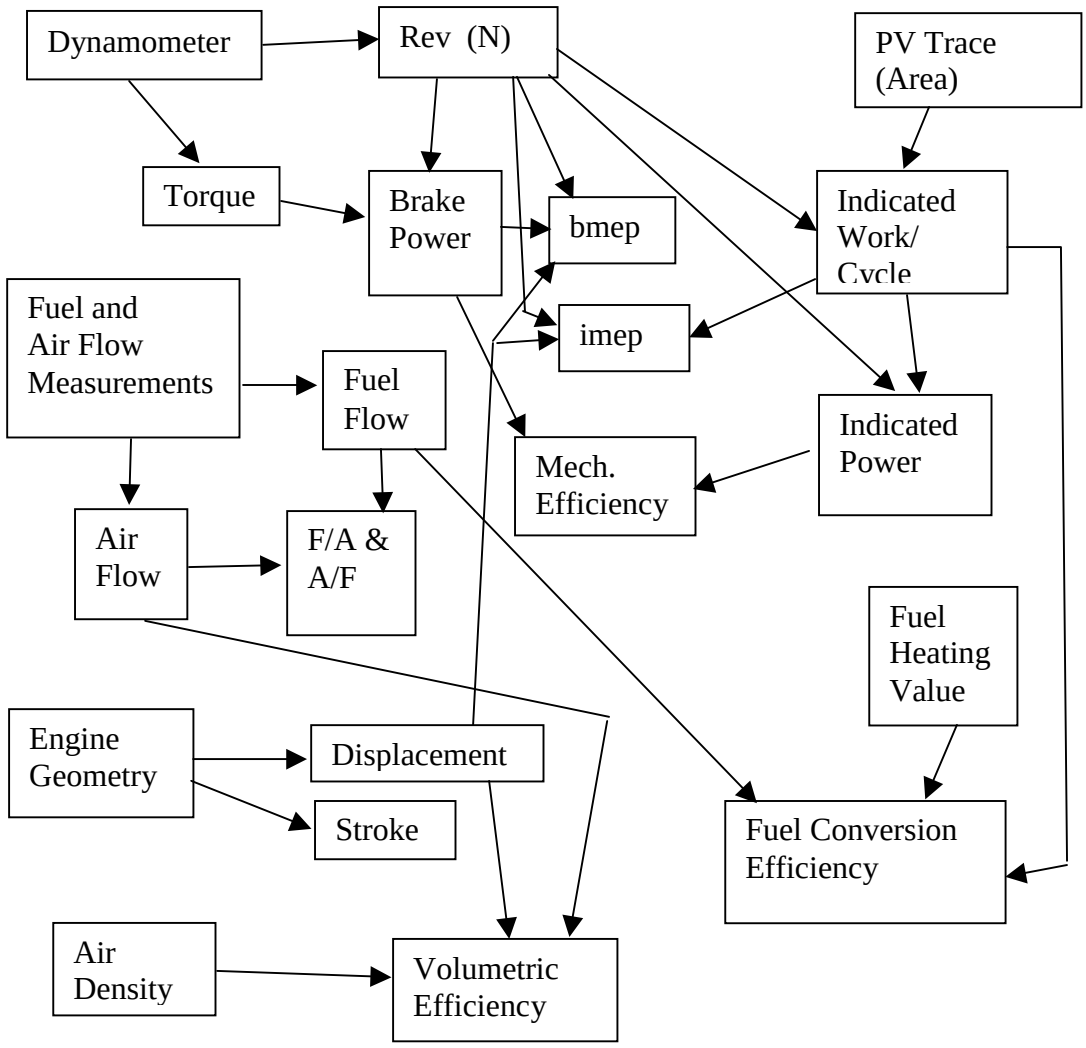
ME 410 Day 8

Topics

- Review of Ch 2 Concepts & Formulas
- Review of Combustion Basics
- Discussion of Test for Thursday

Let us create a concept map of Ch. 2. It might look something like



See if you can find the formula to make the link!

Here is the set of formulas you will be given on the test.

$$P = 2\pi N T$$

$$P = \frac{\eta_f \eta_v \rho_{a,i} V_d N Q_{HV} (F/A)}{2}$$

$$P(hp) = \frac{N(RPM)\, T(ft-lb)}{5252}$$

$$T = \frac{\eta_f \eta_v \rho_{a,i} V_d\ Q_{HV} (F/A)}{4\pi}$$

$$P_i = \frac{W_{c,i} N}{n_R}$$

$$mep = \eta_f \eta_v \rho_{a,i}\ Q_{HV} (F/A)$$

$$P_{ig} - P_b = P_f$$

$$\frac{P}{A_p} = \frac{\eta_f \eta_v \rho_{a,i} L N Q_{HV} (F/A)}{2}$$

$$\eta_m = \frac{P_b}{P_{ig}} = 1 - \frac{P_f}{P_{ig}}$$

$$\eta_v = \frac{2\dot{m}_a}{\rho_{a,i} V_d N}$$

$$mep = \frac{P n_R}{N V_d}$$

$$mep(psi) = \frac{P(hp)\, n_R \times 396000}{V_d(in^3)\, N\ (RPM)}$$

$$sfc = \frac{\dot{m}_f}{P}$$

$$\eta_f = \frac{P}{\dot{m}_f Q_{HV}}$$

$$F/A = \frac{\dot{m}_f}{\dot{m}_a}$$

$$A/F = \frac{\dot{m}_a}{\dot{m}_f}$$

Combustion Basics

Lean Combustion

Here there is excess air. Combustion will be complete, and we will just have extra oxygen and nitrogen in the product burned gas.

$$C_\alpha H_\beta + \frac{a_s}{\phi}\left(O_2 + 3.773\, N_2\right) = b\, CO_2 + c\, H_2O + d\, N_2 + e O_2$$

$$\alpha = b$$

$$\frac{2a_s}{\phi} = 2b + c + 2e$$

$$\beta = 2c$$

$$3.773\left(\frac{2a_s}{\phi}\right) = 2d$$

(We already know that $a_s = \alpha + \beta/4$. Solving we find b and c have not changed. We also find that

$$e = a_s\left(\frac{1}{\phi} - 1\right)$$

and

$$d = \frac{3.773 a_s}{\phi}$$

Class Example

Combustion of Isooctane. C_8H_{18}. Stoichiometric. $\phi = 0.9$

- Write and balance the combustion equation
- Mole fractions of the mixture
- Molecular weight of the mixture
- Mole fractions of the product
- Molecular weight of the product.