# ME 433 Week 7 Homework Spring 2024

## Part I. Modeling Your Selected Engine

For the engine you selected in Week 5 Homework, come up with you best (thoughtful) guess of the following parameters. Break your engine speed up into 6 even steps that represent idle through peak RPM. At each engine speed make estimations for:

1. Volumetric efficiency as a function of engine speed (for WOT only)
2. Mechanical efficiency as a function of engine speed (for WOT only)
3. Combustion efficiency as a function of engine speed
4. Cycle efficiency as a function of engine speed

## Part II. WOT Curves for Your Engine

Using the values you chose in Part I, calculate the torque output and power output of the engine at each of the six engine speeds explored.

1. On a single plot show your calculated curves for Torque and Power vs. RPM. For torque you can use [N\*m[ or [ft\*lbf], and for power you can use [kW] or [hp]. If your torque and power magnitudes are too different you can plot them on separate plots, or use a different axis on the left and right sides.
2. Compare your torque and power curves to the curves you found for your engine from Week 5 Homework. You can use this comparison to refine your estimations from Part I if you like. Comment on similarities and/or differences between the published curves and your simulated curves.
3. Using your torque vs. RPM data, make a plot that shows BMEP [kPa] vs MPS [m/s] for your engine. For each of the six data points for your plot, show the value of sfc in units of [gm/kW-hr]

## Part III. Instantaneous Volume

For the engine you chose, either estimate, or find a value for the connecting rod length (center-to-center).

1. Make a plot of V/Vmax as a function of crank angle (0-360°).
2. Then overlay a plot of V/Vmax as a function of crank angle if the connecting rod were 1.5x longer than the original.
3. On the plot from parts a and b, overlay a plot of a simple cosine wave that goes from V\_tdc to V\_bdc and back. This function should look like:
4. Comment on trends you see here. Pay special attention to what is happening near TDC and BDC

## Part IV. Basic Engine Calculations

A twin-cylinder 2-stroke engine has a total swept volume of 150 cm3. 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 following:

1. BMEP [kPa]
2. Arbitrary overall efficiency [%]
3. Volumetric efficiency [%]