#  ME 433 Exam 2 – Take Home Spring 2024

With time in the semester running short I’m giving the option to either:

1. Complete your proposed project (possibly with a reduction in scope)
2. Work this take-home exam

## Part I. Size a Forced Induction System for your virtual engine

You had been making a virtual engine in earlier homework assignments. For your engine from Homework 7, Part II (or you can choose a different engine if you like) you should design a forced induction system for this engine. You should provide calculated data for full-throttle torque and power output for your Forced-Induction engine at six different engine speeds (low range to peak RPM).

If you are going to pick a positive displacement supercharger then you will need to specify the size (displacement per revolution) for the supercharger, then at each engine RPM calculate the following:

* Drive ratio between crankshaft and supercharger
* Boost pressure in the intake
* Temperature in the intake
* Power removed from crankshaft necessary to power the supercharger
* Density of the air in the intake

If you are going to pick a turbocharger then you will need to specify the compressor and the turbine selected. At each RPM you should show:

* Data point on the compressor map
* Data point on the turbine map
* Boost pressure in the intake
* Exhaust backpressure (from matchbot)
* Temperature in the intake (note if you are using an Intercooler or not, and if so, what the effectiveness of the intercooler is)
* Density of the air in the intake

For either your Supercharged engine or Turbocharged engine, use the Power and Torque Equations from Lecture 7 to give power and torque numbers for each RPM.

$$P=\frac{η\_{m}\*η\_{t}\*η\_{c}\*Q\_{HV}\*η\_{v}\*p\_{bdc}\*π\*B^{2}\*L\*n\_{cyl}\*N}{4\*\left(1-^{1}/\_{CR}\right)\*AFR\*R\*T\_{bdc}\*n\_{R}}$$

$$T=\frac{η\_{m}\*η\_{t}\*η\_{c}\*Q\_{HV}}{AFR}\*\frac{η\_{v}\*p\_{bdc}}{R\*T\_{bdc}}\*\frac{B^{2}\*L\*n\_{cyl}}{8\*\left(1-^{1}/\_{CR}\right)\*n\_{R}}$$

## Part II. Put your Forced Induction engine in a virtual vehicle

You should be able to use the data from Part I, along with inputs about your vehicle to model a 0-60 mph acceleration. Or, if you prefer, a ¼ mile drag race. For your model provide all of the same things done for Week 8 Homework.