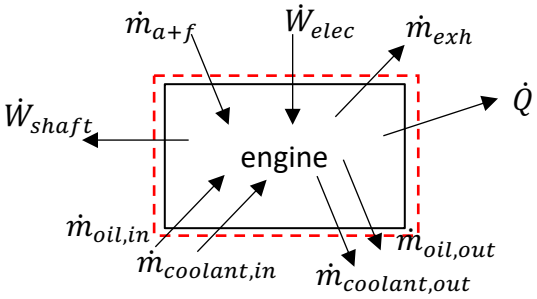
We are interested in developing a model for the power generated by an internal combustion engine (shown in the following figure).

Draw an appropriate control volume that one could use for applying conservation of mass and the First Law of Thermodynamics in order to relate the power generated by the engine to other relevant parameters.

SOLUTION:
Since we're specifically interested in the power generated by the entire engine, draw a control volume (shown as a red dashed line) that surrounds the whole engine as shown below. Also draw the mass and energy exchanges between the control volume and the surroundings.



There are many mass and energy exchanges between the surroundings and the control volume, such as:

- Mass flow rate of fuel and air into the engine, $\dot{m}_{a+f}$
- Mass flow rate of exhaust from the engine, $\dot{m}_{exh}$
- Mass flow rate of oil into the engine, $\dot{m}_{oil,in}$
- Mass flow rate of oil out of the engine, $\dot{m}_{oil,out}$
- Shaft power from the engine, $\dot{W}_{shaft}$
- Rate at which heat leaves the engine, $\dot{Q}$
- Electrical power into the engine to ignite the spark plugs, $\dot{W}_{elec}$
- Mass flow rate of coolant into the engine, $\dot{m}_{coolant,in}$
- Mass flow rate of coolant out of the engine, $\dot{m}_{coolant,out}$

Now that the control volume and mass and energy exchanges are indicated, the analysis of the engine could proceed by applying Conservation of Mass and the First Law of Thermodynamics to the control volume.