ME202 – THERMODYNAMICS

Home Study 2

Section: N/A
Due Date: N/A

PROBLEMS

1. How are heat, internal energy, and thermal energy related to each other?

2. A water jet that leaves a nozzle at 60 m/s at a flow rate of 120 kg/s is to be used to generate power by striking the buckets located on the perimeter of a wheel. Determine the power generation potential of this water jet.

3. On a hot summer day, a student turns his fan on when he leaves his room in the morning. When he returns in the evening, will the room be warmer or cooler than the neighboring rooms? Why? Assume all the doors and windows are kept closed.

4. Consider an electric refrigerator located in a room. Determine the direction of the work and heat interactions (in or out) when the following are taken as the system: ***(a)*** the contents of the refrigerator, ***(b)*** all parts of the refrigerator including the contents, and ***(c)*** everything contained within the room during a winter day.

5. A 75-hp (shaft output) motor that has an efficiency of 91.0 percent is worn out and is replaced by a high-efficiency 75-hp motor that has an efficiency of 95.4 percent. Determine the reduction in the heat gain of the room due to higher efficiency under full-load conditions.

6. Consider a room that is initially at the outdoor temperature of 20°C. The room contains a 100W light bulb, an 110W TV set, a 200W refrigerator, and a 1000W iron. Assuming no heat transfer through the walls, determine the rate of increase of the energy content of the room when all of these electric devices are on.

7. An escalator in a shopping center is designed to move 30 people, 75 kg each, at a constant speed of 0.8 m/s at 45° slope. Determine the minimum power input needed to drive this escalator. What would your answer be if the escalator velocity were to be doubled?