

Thermodynamics (MEL2020)
Indian Institute of Technology Jodhpur

Tutorial-8

Date: 23rd March 2022

Instructions:

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- *Answer all the questions*
 - *Please write your solutions/explanations on an A4 size paper with your own handwriting*
 - *Scan all pages as a single pdf file and upload in google classroom before 8 PM same day*
 - *This will give you **1 point** towards your total evaluation*
 - *Late submission lead to deduction of **half mark**.*
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1. A refrigerator operating on the reversed Carnot cycle has a measured work input of 200 kW and heat rejection of 2000 kW to a heat reservoir at 27 °C. Determine the cooling load supplied to the refrigerator, in kW, and the temperature of the heat source, in °C.
2. A household refrigerator that has a power input of 450 W and a COP of 2.5 is to cool five large watermelons, 10 kg each, to 8 °C. If the watermelons are initially at 20 °C, determine how long it will take for the refrigerator to cool them. The watermelons can be treated as water whose specific heat is 4.2 kJ/kg °C. Is your answer realistic or optimistic? Explain.
3. A coal-burning steam power plant produces a net power of 300 MW with an overall thermal efficiency of 32 percent. The actual gravimetric air-fuel ratio in the furnace is calculated to be 12 kg air/kg fuel. The heating value of the coal is 28,000 kJ/kg. Determine (*a*) the amount of coal consumed during a 24-hour period and (*b*) the rate of air flowing through the furnace.
4. Refrigerant-134a enters the evaporator coils placed at the back of the freezer section of a household refrigerator at 100 kPa with a quality of 20 percent and leaves at 100 kPa and - 26 °C. If the compressor consumes 600 W of power and the COP of the refrigerator is 1.2, determine (a) the mass flow rate of the refrigerant and (b) the rate of heat rejected to the kitchen air.