Thermodynamics (MEL2020)
Indian Institute of Technology Jodhpur

Assignment-9 Date: 24th March 2022

Maximum points: 1 **Instructions:**

- *Answer all the questions*
- *Please write your solutions/explanations on a paper with your handwriting*
- *Scan all pages as a single pdf file and upload in google classroom before 27-03-22*
- *This will give you **1 point** towards your total evaluation,*
- ***Late submission lead to deduction of half mark.***

1. An automobile engine consumes fuel at a rate of 22 L/h and delivers 55 kW of power to the wheels. If the fuel has a heating value of 44,000 kJ/kg and a density of 0.8 g/cm^3, determine the efficiency of this engine.

2. A heat pump is used to maintain a house at a constant temperature of 23 °C. The house is losing heat to the outside air through the walls and the windows at a rate of 60,000 kJ/h while the energy generated within the house from people, lights, and appliances amounts to 4000 kJ/h. For a COP of 2.5, determine the required power input to the heat pump.

3. A heat pump operates on a Carnot heat pump cycle with a COP of 8.7. It keeps a space at 26 °C by consuming 4.25 kW of power. Determine the temperature of the reservoir from which the heat is absorbed and the heating load provided by the heat pump.

4. The food compartment of a refrigerator, is maintained at 4°C by removing heat from it at a rate of 360 kJ/min. If the required power input to the refrigerator is 2 kW, then determine the coefficient of performance (COP) of the refrigerator and also determine the rate of heat rejection (Q_H) to the room that houses the refrigerator.

5. An air-conditioner with a power input of 1.2 kW is working as a refrigerator (COP = 3) or as a heat pump (COP = 4). It maintains an office at 20 °C year round which exchanges 0.5 kW per degree temperature difference with the atmosphere. Find the maximum and minimum outside temperature for which this unit is sufficient.