

Thermodynamics (MEL2020)
Indian Institute of Technology Jodhpur

Tutorial-2

Date: 19th January 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 and upload in google classroom before **6 AM (20th January 2022)***
 - *This will give you **1 point** towards your total evaluation*
 - *Late submission lead to deduction of **half mark**.*
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1. For a cycle, is the network necessarily zero? For what kind of systems will this be the case?
2. Consider a river flowing toward a lake at an average velocity of 3 m/s at a rate of 500 m³/s at a location 90 m above the lake surface. Determine the total mechanical energy of the river water per unit mass and the power generation potential of the entire river at that location.
3. A fan is to accelerate quiescent air to a velocity of 8 m/s at a rate of 9 m³/s. Determine the minimum power that must be supplied to the fan. Take the density of air to be 1.18 kg/m³.
4. Balloons are often filled with helium gas because it weighs only about one-seventh of what air weighs under identical conditions. The buoyancy force, which can be expressed as $F_b = \rho_{air} g V_{balloon}$, will push the balloon upward. If the balloon has a diameter of 12 m and carries two people, 85 kg each, determine the acceleration of the balloon when it is first released. Assume the density of air is $\rho_{air} = 1.16 \text{ kg/m}^3$, and neglect the weight of the ropes and the cage.