Class :3rd stage

Subject: Thermodynamics

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(Thermodynamic Lab3)

Experiment No. 1

(Air speed measurement)

اعداد:

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Number of Experiment: Experiment number one.

Name of Experiment: Air speed measurement.

Purpose: Calculate air speed.

Equipment: Used equipment in this experiment are:

1. Anemometer which is used to measure air speed (V_{air}) as shown in Figure below.
2. Data Logar which has two thermocouple and used to measure inlet and outlet temperature.
3. Blower and control unit.

Fig: Anemometer.

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Theory:

Air is all around us, but we cannot see it. Gravity from the Earth pulls air down - this is called air pressure. We don't feel this pressure because our bodies push an equal amount of pressure outward.

Everything is made from molecules, the air also contains molecules. The temperature outside on any given day is determined by the speed of air molecules.

When the airspeed increases the temperature increases too due to the increase of air molecules movement and vise versa. Generally, the larger the temperature difference, the larger the resulting airspeed will be.

The airspeed is important information for accurate navigation of an aircraft. To maintain a desired ground track whilst flying in a moving air mass, the pilot of an aircraft must use knowledge of wind speed, wind direction, and true air speed to determine the required heading. So it is important to measure the airspeed and this done by an instrument called an anemometer which measures the airspeed by monitoring the amount of heat removed from a surface using one or more simple temperature sensors.

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Procedure:

1. Fix anemometer and the two thermocouple (one for the inlet temperature (T_{in}) and the other for the outlet temperature (T_{out})).
2. Record outlet temperature which is constant in the experiment.
3. Take the first reading of speed, inlet temperature and pressure.
4. After 1-2 minutes, change the speed and record T_{in}, V and P again and repeat this step until reach the required number of readings.
5. Make a table with results as below:

No.	T_{out} (^oC)	T_{in} (^oC)	V_{air} (m/s)	P
1				
2				
3				
4				

Requirement:

1. Draw curve between T_{in} and V_{air} at constant T_{out}.
2. Define anemometer.
3. Calculate mach number (M_a) by using equation below:

$$M_a = \frac{V}{661.9 * \sqrt{\frac{T(in)}{T(out)}}}$$